PREHealth

Teaching a location-based game design course to promote physical activity and social interaction in urban open spaces.

An educational manual for secondary and higher education, educators of chronically ill children, and adult learners.

Erasmus+ PREHealth

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www.prehealth.eu

Terms of References

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Project Partners

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PREHealth

Content

Instructions

This manual aims at providing any interested educator - formal or not - with the necessary framework, material, and guidance for implementing a location-based game design course to promote physical activity and social interaction in urban open spaces.

The first section presents materials and concepts that help introduce, structure, and carry out a course for various target group. The *introduction* presents the challenges faced by cities and citizens, and the motivation to develop a manual to design a location-based game (LBG) to promote physical activity and social interaction in urban open spaces. The *course description* gives a quick overview of the necessary framework to structure a course, followed by *material basis*, where core concepts that need to be addressed throughout the course - such as what is a LBG and how it can be used as an education and learning tool - are discussed, and material for different stages of the course is presented.
The material compiled in this first section will be of interest to readers who are new to the topic.

The second section of the manual presents in detail examples of four courses in different contexts and therefore for different target groups:

1. Secondary education - describes a course for second stage pupils,

2. Higher education - specifically for architecture and urban design students, but previous experience show that it is also appropriate in an interdisciplinary setup,

3. Adult learners - this part gives a short introduction to a self-learning package, presenting the topics and chapters that are covered by the learning material, and

4. Chronically ill children - This example contains informations for both students in higher education (computer science) and chronically ill children.

Each part of the second section will offer conclusions and recommendations as well as further material adapted to the needs of the target groups.

We hope that educators, students, designers, planners, policy makers, game enthusiasts, and self-learners, will find the materials gathered and presented here stimulating and useful.

First Section

Introduction

The spaces we live, work, and play in have an impact on our behaviour and the type of interactions we have on a daily basis. Changes such as the ongoing urbanization, steady growth of urban populations, and cultural and infrastructural transformations are forming and (re) arranging both our lifestyles and the spaces we live in. For example, physical inactivity and isolation are rising in cities worldwide, taking a toll on city dwellers' health and wellbeing.

Modern life in cities have been shown to demand less physical activity then our bodies require; nowadays minimum standards of physical activity are seldom reached. This is in part due to the lack of necessity – e.g., in the modern city, basic needs, such as acquiring food, can be satisfied with little physical effort –, and sometimes lack of opportunities to be active in the urban space – e.g., no adequate space to become active is available or it isn't easily accessible. The general trend in the European Region is towards decreasing physical activity levels[1], a worrying trend.

Infrastructural and social changes, such as urbanization and densification, are often leading to the decrease of green and blue infrastructure in cities (parks, lakes, etc.). These spaces and elements have been proven to provide health benefits to citizens. Some city dwellers may have little to no access to natural environments in big cities.
Green and blue open spaces are ideal opportunities to be physically and socially active. However, citizens aren't usually fully aware of neither the opportunities to become active nor of the health benefits from a more active usage of local and city-wide green and blue open spaces. The challenges must be dealt with both as a private and as a public concern. Citizens need to learn more and be aware of the consequences that lack of physical activity lead to at a personal level, and be able to identify opportunities to carry out healthy activities. Cities must learn to tackle and counteract the decrease of infrastructure and amenities that promote healthy behaviours.

Telecommunications and new media technologies allow us to connect and communicate with others in new ways, enabling us to think about space differently, and interact with others in real time despite broad distances. Mobile technologies influence our understanding, experience, and production of the urban environment, and open up the opportunity to develop location-based games that encourage participants to become immersed in playful and meaningful interaction.

In order to make the broader public aware of the challenges and opportunities, the PREHealth project designed and implemented four courses for different target groups: higher and secondary education students, chronically ill children, and adult self-learners. Throughout the courses, participants learn about opportunities in their city, analyse local open spaces, and develop creative strategies supported by mobile technology. The final products of the course are location-based games that promotes physical activity and social interaction, tailored to the needs and context of its users, and ready to use!

1 WHO Regional Office Europe, 2015

Course description

Marianne Halblaub Miranda, Fouli Papageorgiou

Course structure

The first step is to compile a course description. The following table will help you define and describe the course and learners, and be aware of what needs to be gathered before starting. The table contains explanations for each suggested category.
These are general guidelines that must be adapted according to the context and local goal; or maybe you have your own course description guidelines in your institute, which can be complemented with the suggested content.

Learner (target group)	Who will join the course?
Teacher (course developer)	Who will prepare and teach the course? In the case of self-learners, learner and teacher are both.
Discipline	Is the course only for one discipline or interdisciplinary; is it for a specific school subject?
Workload	In teaching units or credits
Duration	E.g. in weeks or semester
Course format	How should the interaction between teacher and learner, or learner and learner take place? For this course, we used and suggest **project work**, a format focused on delivering a product.
Course content*	What will participants do and learn? Define tasks and classify the type of knowledge the students will acquire. Describe the tasks as specific as possible.
Learners' background	What should the learner already know and be able to do?
Age	Is there an age limit for the course? This will have implications on the topics that can be taught, the activities that can be carried out, and the depth to which these can be mastered.
Equipment*	Which equipment and materials will you need? For this course, students will work both **in class** as **on the field**. Please keep in mind that different types of equipment and materials are needed.
Teachers' skills*	What should the teacher be able to convey and assess? For this course some specific skills are needed (e.g. IT or game design skills). If the teacher lacks of some of the necessary skills, it must be possible to invite an external expert to cooperate with the class.

For an example of a table with general indications (*) that apply to all target groups, see Appendix A. For the detailed examples for each target group, please see the course description tables in section two.

Once you have described the course content, you can derive the **learning objectives and outcomes** (*what* should be taught and what should the learner know or be able to do by the end of the course), assign the **teaching and learning activities** that best suit the objectives and outcomes (*how* the content will be taught and learned), and define **assessment and feedback** strategies (*how* to measure if the objectives are met and how well).

Learning objectives and outcomes

The following general learning objectives are sorted by project stages, listing learning outcomes that fit the majority of the presented target groups.
You can find the detailed lists with additional or differing learning objectives and outcomes adjusted to the target groups in section two.

To define the scope and set the basis	To describe the importance of blue and green infrastructure in the urban environment and for city dwellers' physical and mental health
	To recognize that the active use of open spaces can positively influence the mental and physical health of city dwellers
	To identify the potentials of LBG for informal learning about one's health and well-being while actively using urban open spaces
	To develop and apply a research mentality, as well as critical and creative thinking about the use of public spaces in promoting health and physical exercise
	To formulate (as independently as possible): motivation, objectives, methodology, evaluation, results, and conclusions.

To analyse the urban context	To define and apply digital tools for analysing and sharing information about open spaces in own city To research, collect and analyse data, and carry out assessment and synthesis work within the analytical framework of physical activity and social interaction in urban open spaces To organize and evaluate the material collected in the field (photos, videos, etc.) To identify potentials and weaknesses to promote health related activities in the area of interest
To create a game concept and design the game	To apply game design To build a simple scenario and story of a location-based game To engage in creative writing/sketching and build a simple scenario for a LBG To discuss, collaborate and participate in a creative process To derive information about the open space through field and desk research and relate these to the content of the game storytelling To select appropriate software for collecting and editing material for game content
To develop a game	To develop a digital game for mobile devices using ICT tools To explore use of digital media and instructional resources for learning
To test prototypes and final game	To test the resulting prototypes and game with users of the open space To carry out an evaluation on site during prototype testing and after the game testing To document and incorporate evaluation results from the prototype testing in to the further development of the game
To report and present	To document and reflect upon evaluation results from the game testing To present final results (written and oral)

Further competencies, attitudes, and skills	To discuss and debate a variety of issues, showing respect for different views To develop a spirit of cooperation and responsibility To adopt good practices with regard to the use of mobile devices To raise awareness on the issue of health and physical exercise in the city resulting in a positive attitude towards health-related activities To encourage others (friends, family, neighbours) to actively use the urban public space and actively participate in its improvement

Learning activities and feedback

These are the formats for learning activities proposed in the example courses. The list should serve as explanation and inspiration to further develop formats that suit the teachers' and students' needs in their own context.

Lecture	It can be imparted as a classical frontal lecture (only the teacher prepares and presents a certain theme) as well as involving the students in more active learning process. Examples of exercises would be having students prepare parts of the materials that will be dealt with in the upcoming lecture and have them present ("learning by teaching") and debate about the meaning and importance of the concepts ("class discussion"/ "student debate").
Workshop	Students must engage in intense discussion and activity, working on creating and gathering materials. The teacher or an expert is there to support them.
Hackathon	Is a workshop-like event implemented often in software and hardware projects. The main goal is to create usable prototypes in order to have a functioning product by the end of the session. It is advised for our purposes, that the student groups assign their member different roles (e.g. a leader, a designer, a programmer, a project manager) to concentrate in certain tasks and keep them on track with the process.

Field work	Students (with or without teacher) go on site to the open spaces to gather material or test the games. This may include informal interviews with the open space users, direct observation of how the space is being used, or the production of mapping materials for the analysis phase.
Advisory session	Students present directly to the teacher (1) what they are working on / in which stage they are in, (2) what materials they have gathered or created, (3) if they are having trouble with any task or have any open questions, and (4) what are the planned next steps. The teacher gives direct feedback on both what has been accomplished successfully (positive feedback), what needs to be improved, and point towards next steps and inform about where to get the information or materials to advance in the task.
Peer feedback	The students have the opportunity to give each other feedback. Every student or student group must have a feedback buddy, who will first listen to (1) what they are working on, (2) what materials they have gathered or created, (3) if they are having trouble with any task, and (4) what are the planned next steps. The feedback buddy will point out (1) what they find positive and successful about the approach, (2) hint towards inconsistencies or missing deliverables, and (3) ideally offer possible solutions. There are various ways of integrating this to a session. Here are two examples: Format 1: supervised by the teacher. The groups will listen and then give feedback, the teacher will add any missing feedback at the end of the round between students. Format 2: the students give each other feedback taking turns, they then summarize what was discussed and what their following steps are, and present this to the teacher in the big group, who can then add any missing feedback. This format encourages communication between different groups, includes the majority of the group in discussions, and allows the students to reflect on their own solutions while having to assess somebody else's work.

Assessment and feedback material

See Appendix B with examples of evaluations done by both the course developers (educator) as well as by the students.

Overview: Learning objectives and outcomes for all lea

	Part 1: Secundary education students	Part 2: Higher education students	Part3: Adult learners
To define the scope and set the basis	• To recognize that the active use of open spaces can positively influence city dwellers' wellbeing • To describe the importance of blue and green infrastructure in the urban environment and for c • To develop and apply a research mentality and/or critical and creative thinking about the use of • To identify the potentials of LBG for informal learning about one's health and well-being while ac • To formulate (as independetly as possible): motivation, objectives, methodology, evaluation, res	• To learn about urban design that actively promotes users' health	
To analyse the urban context	• To define and apply digital tools for analysing and sharing information about open spaces i • To research, collect and analyse data, and carry out assessment and synthesis work within activity and social interaction in urban open spaces • To organize and evaluate the material collected in the field (photos, videos, etc.) • To identify potentials and weaknesses to promote health related activities in the area of int	• To identify potentials and weaknesses to promote health related activities applying urban analysis tools together with other (digital) tools • To understand the relationship between urban open spaces and citizens' behaviours	• To acknowledge th features, facilities multifunctionality spaces
To create a game concept and design the game	• To apply game design • To build a simple scenario and story of a location-based game. • To engage in creative writing/sketching and build a simple scenario for a LBG • To discuss, collaborate, and participate in a creative process. • To derive information about the open space through field and desk research and relate thes • To select appropriate software for collecting and editing material for game content		

arners and suggested learning and feedback activities

	Part 4: Higher education students	Chronically ill children	Suggestions for learning and feedback activities
g ity dwellers' physical and mental health f public spaces for health related activities ctively using urban open spaces sults, and conclusions			• Reading material: IO1, IO5, and other more popular literature • Lecture and discussions about the themes • Prepare short presentations about existing LBGs for health • Advisory sessions and workshops
in own city n the analytical framework of physical erest			• Field work • Advisory session and workshop • Discussion of the gathered material and preparation of a common siftr
ne and of open		• To learn to self-reflect on their illness-related needs	
se to the content of the game storytelling			• Reading material: IO5, IO6, and other more popular literature • Workshop • Hackathon • Advisory session
	• To implement the co-creation process with other actors and stakeholders in a timely, transparent, and responsible way	• To experience giving constructive input to the design of the location-based game	

	Part 1: Secundary education students	Part 2: Higher education students	Part3: Adult learners
To develop a game	• To develop a funtioning prototype of a digital game for mobile devices using ICT tools. • To explore and use digital media and instuctional resources for learning		• To develop the dig competences in g
To test prototypes and final game	• To test the resulting prototypes and game with users of the open space • To carry out an evaluation on site during prototype testing and after the game testing • To document and incorporate evaluation results from the prototype testing in to the further		
To report and present	• To document and reflect upon evaluation resultsfrom the game testing • To present final results (writen and oral)	• To present final results (written, oral, and drawings/ sketches/models/mock-ups as commonly used in the discipline)	
Further competencies, attitudes, and skills	• To discuss and debate a variety of issues, showing respect for different views • To develop a spirit of cooperation and responsibility • To adopt good practices with regard to the use of mobile devices • To raise awareness on the issue of health and physical exercise in the city resulting in a po • To encourage others (friends, family, neighbours) to actively use the urban public space an • To propose solutions to improve the urban open space, develop green spaces and promote		

	Part 4: Higher education students	Chronically ill children	Suggestions for learning and feedback activities
			• Workshop • Hackathon • Advisory session
ital eneral		• To learn to critically think about the experience of co-creating and playing the game.	
r development of the game			• Field work • Advisory session • Handing out and discussing examples of evaluation questionnaires (Appendix)
		• To experience play testing of the resulting game	
			• Direct feedback • Peer feedback is also welcomed • Final presenations and discussion of about 20 min per game (group)
sitive attitude towards health-related activities d actively participate in its improvement e opportunities for health related activities			

Material basis

Urban and location-based games

LBG as education and learning tools

Game concept

Process of Game design

Selected AR tools and their potential to raise awareness and encourage active civic participation

PREHealth LBG for secondary education, higher education, adult learning and education of chronically ill children

Glossary

Opportunities

The Health and Fitness Itinerary

Demetris Mylonas, Marianne Halblaub Miranda

Urban and location-based games

Urban games take place and evolve in urban settings. Due to their strong connection to the urban context, various urban games are location-based games (LBGs). In a LBG the game story and the tasks develop and progress according to the player's location. These games allow the players to refer to physical objects and location(s), and use their creativity and imagination in order to interact meaningfully with others and the location. Such interactive narratives and playful activities are facilitated by mobile devices in such a way that the game activity follows the players' location (Avouris & Yannoutsou, 2012).

These games can be a crucial element in the relationship between cities and human beings (Borries et al., 2007); a game experience could modify the link between the city and its inhabitants, making it richer, more interesting, and more involving. This can be supported by the game's ability to engage users in a specific behaviour within a specific context thanks to their playful and entertaining properties (Walz, 2010).

Examples of LBG

- 99 tiny games (2012) Hide & Seek Studio, London.
- Ingress (2012) Google's Niantic Labs
- Pokémon Go (2016) Niantic and Nintendo
- Zombies run! (2012) Six to Start and Naomi Alderman

LBG as education and learning tools

The universal use of mobile devices, such as smartphones and tablets, and the fast evolution of game technology, have provided great opportunities to develop location-based games that encourage participants to become immersed in playful and meaningful interactions, using different layers of information. This is why LBGs have found the most diverse applications; some are being used to promote city exploration[1] or nature conservation[2], while others are simply produced for entertainment[3].
LBGs also offer real opportunity for learning and storytelling about specific locations and routes, introducing the natural or built environment as a participant in the players' interaction and experience. Some games aim to involve children and teach them about the built environment, urban planning,

1 See the Dérive app: http://deriveapp.com

2 See the INVOLEN project: http://www.involen.eu/en/learning-tools-resources/mobile-games

3 See Pokémon Go: https://pokemongolive.com

and participation processes (See Poplin, 2012; Tóth & Poplin, 2013; 2014). Others have as main objectives to encourage social interaction and physical activity (see Verhaegh et al., 2006).

LBGs have an important feature that makes them valuable for education: they connect places and stories. In an LBG, it is possible to embed extra layers of information and narratives about, for example, historical locations or other places in a city. By visiting real places, the story becomes a personal experience linking physical objects with learning content. This conveys to the player location-specific knowledge, which is easy to remember, exploiting the connection between the real world and the game (Lehmann, 2012).

These are some of the objectives that could be met through a LBGs:

- participants develop and increase their motivation to learn through discovery and exploration,
- participants exercise their creative imagination through game-based learning techniques and design thinking,
- participants develop collaborative learning skills, but also health literacy skills, artistic skills, ICT skills, citizenship skills, and participants learn to collect and use information to solve problems and develop an inquiring mind.

When considering game design in an educational context, it is important to define the tasks, activities and challenges to be included in the design, but also note down the learning outcomes (what the player must be able to do at the conclusion of the game) that can be mapped against such activities and challenges.

Game concept

The game concept of PREHealth aims to encourage and mobilise citizens to use urban open spaces more actively for their health preservation. Through the game, players will be motivated to perform physical activities, and interact with other visitors - both leading to improvement of their mental and physical health.
The game should raise awareness about health and (lack of) physical activities in the city.
As a further step, the development of the game could lead to the proposition of solutions to improve urban open spaces to further the promotion of health-related activities.
An important part of the game concept is the theme that will be chosen by the educators and co-developed by the students/participants as the basis for designing an LBG along a Health and Fitness Route in their city. We offer here an example of such a theme, which has been used by some of the learner-groups in the PREHealth cities to build their games
The game theme includes a main idea and a number of components. The game idea tried out in the context of PREHealth is that of "Neighbourhood Olympics": people compete in different imaginary Olympic sports, exploiting opportunities to exercise their creativity and imagination as well as their body.

Examples of open-space-friendly "Olympic sports"	cross-pavement obstacle course – walking or jogging, nature-gymnastics or pavement-gymnastics (using features of open spaces, like trees or bars obstructing car parking), running or cycling-with-friends-tour, grocery shop tennis. Players can also submit their own sport ideas.
Narrative	Players are challenged to enter their very own city Olympics where new missions are unlocked along the Health and Fitness Route. With famous Olympic medallists or historic persons or mythology heroes as coaches, the players will be training in various open-space-friendly Olympic sports like those mentioned above - and many others created by the game designer groups.
Game	Each time a player unlocks a mission, the coach will give them a goal, e.g. perform one of the sports included in the location of the player. Various ways can be invented to confirm that the missing is complete and a medal can be unlocked.
Community	Players can form a community and play the game as a group of competing or cooperating athletes: they can organize a neighbourhood-Olympics day when they compete in their own invented Olympic games.

Process of game design

Working with amateur game designers is a challenge. However, given that the emphasis is placed mostly on the learning aspects of the game design process, the challenge can be transformed to substantial learning benefits, leading to improvement of knowledge and skills of the designing groups, as well as raising their awareness and sensitivity on issues that concern the green and blue infrastructure of cities.
The process of creating the PREHealth game includes three main stages: the preparatory work, the actual game design, and the playtest and refinement. The sequence of applying these stages in a learning environment can be briefly as follows:

Stage A Preparatory work

step 1: write a backstory
step 2: find a location
step 3: brainstorm the story within the designing team
step 4: choose the non-playing characters (the protagonists of the game other than the players)
step 5: choose a gaming platform to build the game

Stage B Game design

1. game introduction
2. game architecture:
    a. goal of the game
    b. rules – what you can and cannot do
    c. physical exercise challenges: "missions" or mini-games included in the overall game
3. dialogues with the non-playing characters, to provide instructions and encouragement
4. game assets: photos, videos, art

Stage C Playtesting

To check what works and what doesn't, and how to improve it

To read more about games in education, and a more detailed description of the game design process, consult the document A Conceptual Model for location-based games, developed in the framework of the PREHealth project (Papageorgiou et al., 2019).

Selected AR tools and their potential to raise awareness and encourage active civic participation

In the framework of PREHealth, a set of Augmented Reality[4] (AR) tools were selected and integrated with regard to their merits, features and characteristics that qualify them for implementing the developed conceptual model. The proposed AR tools were selected in order to better respond to the following criteria:

- Open source and free of charge: The tools selected are open source and free of charge, at least in their proposed version for application, in order to make sure they can be easily adopted within a variety of learning frameworks, both formal and informal.

- Easy to apply: The selected tools are easy to use, without demanding any expertise in programming by the developer. Although the level of complexity and available features vary from tool to tool, they all include friendly user interfaces in editor mode, inviting developers/editors to explore their capabilities and experiment. All selected tools can be applied by all target group members in different educational settings, both teachers/trainers and learners.

- Great potential for learning and awareness raising: All selected tools have been tested in the past by PREHealth project partner organisations regarding their learning and awareness raising potential, and their capabilities in this field, both in formal and informal educational settings, have been proven and documented. They can facilitate learning both during their application and afterwards, as finished and freely available learning tools.

- Facilitating engagement and participation of users: All suggested AR tools include a strong component of encouraging the users' engagement and active participation. Users are encouraged to engage in physical exercise through the tools' AR features, as well as actively participate in proposing opportunities for health and fitness activities and contributing to the design of their city's open spaces to accommodate such activities.

- Suitability of AR features: In the last few years there are more and more tools available, offering Augmented Reality features on mobile devices. However, not all of them offer features suitable for applying the conceptual model developed within the PREHealth project and pursuing the learning and awareness raising objectives outlined.

- Stability and support: The suggested tools are relatively stable in their applications, their limitations regarding different operating systems for mobile devices have been documented, and include a support centre or an active online support community.

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4 Augmented reality is defined as the integration of digital information with the user's environment in real time. Unlike virtual reality, which creates a totally artificial environment, augmented reality uses the existing environment and overlays new information on top of it

The selected AR tools are:

AR participatory platform

Siftr www.siftr.org

Siftr is an open and free platform for collaborative mapping developed and supported by the Field Day Lab, accessible both from desktop devices (e.g. desktop computer) as well as from mobile devices (e.g. smartphones or tablets), that offers anyone the opportunity to develop collaborative learning activities with reference to the real world, without any particular prior digital skills. It extends learning beyond computers, books and classroom walls – facilitating learning in the real world.

Siftr allows a facilitator[5] to create framework for mapping input according to a certain theme, and then let either a small group of learners or the general public use their smartphones to go out and document geographically relevant material. Siftr gathers this input in the form of photos, text and of course location, and illustrates it so that it is easy to view and discuss the data as a group on a larger display together. An additional feature of Siftr is the ability to interact by adding comments and "liking" certain input (similar to "like" on Facebook). The input is uploaded online on the spot through a smartphone or a tablet, or through a computer by uploading material online. In the framework of PREHealth, the application of Siftr is related to the provision of information and awareness raising on physical activity, active travel and active recreation opportunities, providing feedback on the physical space along and around the "Health and fitness itinerary", and suggesting improvements either related to the facilities and infrastructure present, or to the activities that may be pursued along the itinerary and the benefits for the user's health and wellbeing.

Furthermore, Siftr's features for on-the-scene collaborative mapping are freely available and can be easily used by all, assuming a basic level of skills in using computers and smartphones (i.e. browsing the internet, downloading and installing apps on a mobile device, taking photos).

Finally, Siftr is a responsive web app. **It is designed to be used on smartphones (both Android and iOS) as well as on desktop web browsers.** There are no apps to download, just the custom URL to type in. Though it is possible to use any of the features from any browser, the basic idea is that users on phones, out in the world, will collect data. Then the group or individuals who care about the map as a whole can get together and bring up the site on a larger screen, maybe projected, to discuss or make other assessments from.

5 The facilitator or author of a Siftr in this framework refers to the person or organization who creates the Siftr, defining the purpose of the collaborative mapping activity and setting the parameters of users' engagement.

Platforms for developing and playing AR LBG on mobile devices

ARIS	www.arisgames.org
Enigmapp	www.enigmapp.fr
TaleBlazer	www.taleblazer.org

Hide and seek, I-Spy, police and thieves, role playing games and capture-the-flag have all been popular real-life location-based games that have been played in different versions across the globe. These games allow the players to refer to physical objects and location(s) and use their creativity and imagination in order to interact meaningfully with others, as well as with the location(s). In recent years there has been a rise in the number of creative games, interactive narratives and playful activities that are facilitated by mobile devices in such a way that the game activity follows the players' location. A term used to describe such games is "mobile location-based games"[6].

A location-based game (LBG) is defined as a form of play designed to evolve on a device in motion, directly linking the game experience with the location of the player. To create a location-based experience, usually a connection to other devices, e.g. a server or other players, is necessary.

Location-based gaming offers great educational possibilities, as it allows educators and facilitators of learning to create constructivist experiences rich in educational content. The proliferation of LBGs is due to the widespread use of mobile devices, like smartphones and tablets, with advanced location sensing capabilities like GPS satellite positioning. LBGs can be compelling for young players as well as adults[7]. Video games are, by their very nature, built around interaction and participation. Therefore, they provide a tool for designing curricula that offer more than mere exposure to content, aiming to enrich student experience through active participation[8]. LBGs offer an additional level of experience: due to the fuzzy border between games and real world activities, and because of the resulting changes in the game experience, players become involved and associate with the LBG, thus gaining stronger emotions and satisfaction from well-designed LBGs[9]. Mobile games are particularly suited to creating educational experiences in informal settings. Mobile media and augmented reality can fruitfully combine the advantages of educational video games with place-based learning[10].

6 Avouris & Yannoutsou, 2012.

7 Montola et al.,2009.

8 Squire, 2006, Gee, 2004, Dewey, 1938, Gagnon, 2010.

9 Lehmann, 2012.

10 Squire et al., 2007.

LBGs offer great opportunities to include educational content in the playful experience by using context-aware learning tactics and content generation mechanisms like augmented reality, embedded in a mobile device game or triggered by simple technologies such as QR codes and RFID.

A feature that makes LBGs suitable for education is that they connect places with stories. In an LBG, it is possible to embed extra layers of information and narratives about, for example, historical locations or other places in a city, thus transferring knowledge as well as promoting desirable attitudes and behaviours. By visiting real places, the story becomes a personal experience linking physical objects with learning content. This conveys to the player location-specific knowledge and promotes behaviours through experiential learning, exploiting the connection between the real world and the game[11].

Additionally, an important feature of LBGs that makes their application valuable in the framework of the PREHealth project, is that by their nature they facilitate and encourage the movement of the player in space, especially outdoors. Through the challenge offered by the game, the player is motivated to go out in the real world and move, navigating from place to place both within the game's digital space and in physical space.

Based on the above, the adoption of LBGs as the AR tools to best implement the conceptual model developed in the PREHealth project is most appropriate. The educational capabilities of the LBGs that combine game-based learning and experiential learning, as well as their distinct features for encouraging movement of the players on the physical space and connecting real places to narratives and learning content able to transfer knowledge and actively promote health-related attitudes and behaviours, offer great potential in pursuing the learning objectives and narrative concept outlined in the PREHealth Conceptual Model.

For more information and guidance on how to use the selected AR tools above please refer to the freely available document Informal learning and awareness raising tools (Mylonas et al., 2019).

11 Lehmann, 2012

PREHealth LBG for secondary education, higher education, adult learning and education of chronically ill children

In the framework of PREHealth, seven (7) Location Based Games have been developed during the pilot-testing of the conceptual model and devised AR tools in a variety of educational contexts, i.e. secondary education, higher education, adult learning and education of chronically ill children. The platform TaleBlazer has been preferred, mainly due to its availability and support in both iOS and Android operating systems for mobile devices. Please feel free to see and play the games developed using the instructions below.

TaleBlazer

Instructions for players

1. Download TaleBlazer in the App Store of Google Play Store.
2. Open the TaleBlazer application.
3. Go to the 'menu button' at the top-right corner in the application.
4. Next go to the tab 'Game Code'.
5. Fill in the game-specific code.

For example, for the GameOlypics game this is **gvtemut**
After this, the game can be downloaded and played. See figure 1 for a visual explanation for where to find the above.

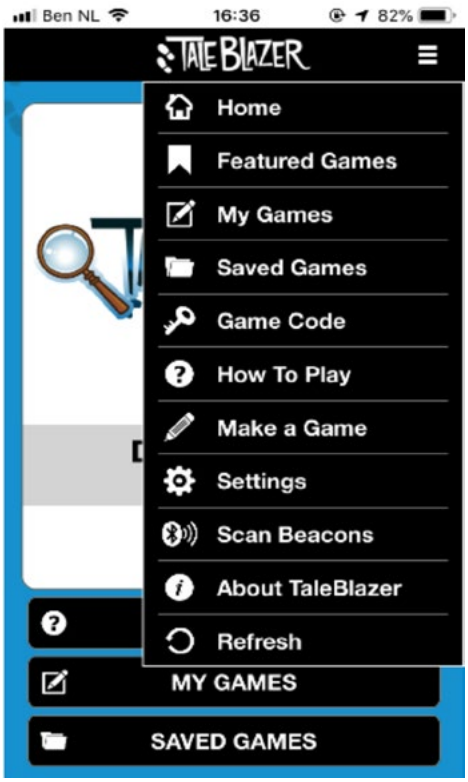


Figure 1. TaleBlazer app menu to fill in the game code / © MIT STEP Lab

Make sure that:

- the game is downloaded while connected to WiFi. When the game is downloaded it can be played offline on location,
- your GPS on your mobile device is turned on, and
- your battery is full, the game can use up some of your phone's battery

Games codes

To see the games created by the project partners use the following codes in the TaleBlazer application.

	Game name	Code
Athens, EL	Διαδρομή Υγείας και Φυσικής Άσκησης / Athens Health and Fitness Itinerary	**gkbngwv**
Darmstadt, DE	Jagd die Schweinehunde!	**grtnfgr**
	Woogletics	**gmboyht**
	Mars Mission	**gkbzevz**
	D-tales	**gfjmeim**
Győr, HU	Győr Health Itinerary	**gyfipvo**
Utrecht, NL	GameOlypics	**gvtemut**

Glossary

Active travel
Moving to a fixed destination with the help of your own muscle power, e.g. walking, cycling or skateboarding to work.

Active recreation
Activities engaged in for the purpose of relaxation, health and well-being or enjoyment (i.e. other than work) in which physical exertion is required, e.g. sports, dancing, gardening or play.

Blue infrastructure (in urban areas)
Comprises all surface waters within a city (e.g. lakes, rivers, coastal water).

Green infrastructure
An interconnected network of green space that conserves natural ecosystem values and functions, and provides associated benefits to human populations.

Health-related behaviour
Any activity undertaken for the purpose of improving health and wellbeing or for preventing and detecting disease, e.g. exercising regularly, eating a balanced diet, and obtaining necessary vaccinations.
PREHealth focuses on the health-related behaviours active travel, active recreation and social interaction.

Physical activity
According to the World Health Organization physical activity can be "defined as any bodily movement produced by skeletal muscles that requires energy expenditure".

Social interaction
Action and communication related to fellow human beings/groups in everyday, public and private situations.

Urban open space
All areas not developed by buildings. Particularly important for PREHealth are green and blue open spaces such as parks, greened road and path networks, squares, bodies of water, etc.

Opportunities

A high percentage of the European population stated in a survey in 2013 that they do sports and are physically active outdoors, either in open spaces like parks or along streets and routes, on their way to their daily activities (see table 1). This presents two opportunities for LBG in open spaces: on the one hand, there are users out there that like and want to be active; making the games a great complement to their PA routine. On the other hand, the LBG can be a motivation and increase the number of open space users by offering a stimulating game.

Where do you engage in sport or physical activity?

	in a park, outdoors, etc.	at a health or fitness center	at home	on the way between home-school/work/ shops
EU28	40%	36%	36%	25%
Germany	42%	42%	46%	27%
Greece	33%	33%	31%	41%
Hungary	16%	14%	51%	29%
Netherlands	37%	51%	35%	29%

Table 1. Answers given by each partner country and the mean value of the 28 European Union Member States (EU28) (based on data from European Commission, 2014, p. 39)

For more detailed information on facts and figures of PA an urban open space, take a look at our publication PREHealth: Designing health into urban green and blue infrastructures – The need for action in planning, policies and education. International Synthesis Report (Halblaub Miranda et al., 2019).

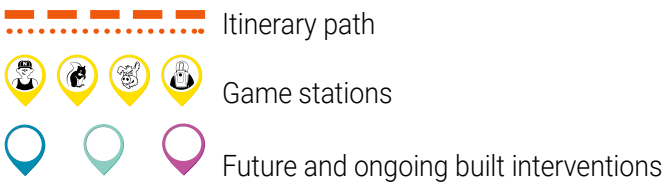
The Health and Fitness Itinerary

The health and fitness itinerary was defined in the project as a network of selected open spaces, in which the acquired information can be disseminated, a broader audience can be motivated to carry out more healthy lifestyles, and the location-based games take place. It not only includes open spaces (parks, green areas, blue infrastructure, etc.) but also the linkages between them (routes). Both the open spaces as well as the routes between them needed to be clearly determined in advance (before the pilot phase!); however, the pilot group could make small adjustments and modifications if necessary while creating the game.

Some of the criteria specified for the itineraries created in the project were:

- it is easily accessible for everybody[12],
- It is (or can be) suitable to promote health-related behaviours (physical activities, active travel and/or social interaction),
- in order to reach a wider audience, the itinerary should contain attractive/ central spaces,
- it should be walkable within maximum 1 hour,
- it should include spaces and infrastructures that cater the needs of the target groups as well (for example enough seating opportunities for elderly people, playing facilities for children, and toilets if it is a long itinerary), and
- it should be suitable for the LBG and for the pilot phase/playtesting.

Figure 2. The Health and Fitness Itinerary in Darmstadt's East. It shows the itinerary path, starting from the city center (right) and ending on the outer skirts of the city (right) with two possibilities to continue the stroll. Additionally, game stations and future and ongoing built interventions are shown in the map.



12 in PREHealth, mostly open **public** spaces were included. In the case of the game for ill children (Part 4 of the second section), the common areas around the hospital, although not open to the general public, where the adequate setting for the target group. In the context of a LBG for a school, a school yard can be part of the itinerary, e.g.

Second section

Part 1:

Manual for teaching a location-based game design course in secondary education

Fouli Papageorgiou, Demetris Mylonas

The present part of the Manual aims at providing educators with the necessary framework, material and guidance for implementing a course in secondary education, focusing on promoting the use of urban open spaces for health and well-being through the development of a location-based game.

The learning course is based on a cooperative interdisciplinary approach. It exploits the cooperative design and development of location-based games (LBGs) and interactive augmented reality (AR) applications for mobile devices (smartphones and tablets) by students, in order to stimulate and promote physical activity in urban open spaces. The games are developed by teams of students, guided by teachers/trainers.

The learning course targets teachers and students of secondary education. Depending on the structure of secondary education in the country and the type of secondary school targeted (e.g. general education school, experimental/model school, science school etc.), the course may be implemented as part of environmental education, research work (i.e. project work), health education, or science education.

1. Course description

Discipline/ Subject	The course integrates a wide range of disciplines and school subjects as follows: **Environmental education:** Introduction to the local environment: natural, built, social, economic; inter-relationship between the natural/built environment and quality of life. Learning to "read" the urban environment and public open spaces; observe the human geography of the city, familiarize oneself with mapping and orientation. **Information and Communication Technology:** Introduction to applications for file-sharing (e.g. Google Drive), communication (e-mail), and office applications (word processing, presentation software). Use of mobile device applications (camera, maps, geo-locating photos). Use of AR applications and platforms for designing location-based games. **Physical education:** Team games: rules, scoring and mechanics. **Health education:** Physical exercise as a component of health improvement, well-being; healthy lifestyles, free time. **Arts and creative writing.** Production by students of original visual artwork, processing image and video, creative writing, scenario development, development of original characters and dialogues.
Workload	30 didactical hours in class and 9-12 hours of fieldwork
Duration	-
Course format	Project work
Course content	Participants will: • learn, research, and report about the relation/interaction between green and blue infrastructure (green open spaces and water elements) and users' behaviours, • formulate motivation, objectives, methodology, evaluation, results, and conclusions as independently as possible (depending on target group), • learn and apply digital tools for analysing and sharing information about open spaces in their own city, • learn to use digital tools for designing and developing games, • adapt a given game concept to their local needs and own game ideas, and • apply/transfer the acquired knowledge to develop/create a location-based game (LBG) to encourage physical activity and social interaction in urban open spaces.

Learners' background	**Knowledge:** Students do not need to have a knowledge background in relation to the theme. They need knowledge on the use of computers and mobile devices and this is enough to familiarize themselves with the tools and software used in the learning process. **Attitudes:** Students are expected to have already developed concepts and attitudes about the use of public open spaces in relation to health benefits, given that healthy lifestyle and the integration of physical exercise in everyday life is a particular concern for modern society. However, students may also have misconceptions about the use of public places and their role in promoting physical exercise and overall health and well-being, which need to be revised.
Age	The course is targeted at students of both genders, aged 14-17 years old.
Equipment	In class room: • Computers with internet connection • Projector • Mobile devices (smartphones, tablets) with WiFi access • Post-it, coloured cardboards In the field: • Mobile devices (smartphones, tablets) with internet connection • Cameras • Camcorders (optional) • GPS devices (optional) • Audio recording devices (optional)
Teacher's skills	• IT skills (and optionally gaming software knowledge), • creative writing skills, • art skills, • physical education skills, and • optionally, game design skills. This type of skills can be best brought into the team by inviting an external expert to cooperate with the class

2. Learning objectives and outcomes

During the course, the aim is to develop the students' self-motivation through discovery/exploratory learning; exercise their creative imagination through game-based learning techniques and design thinking; and develop collaborative learning skills through a project-centred approach. Moreover, regarding the use of digital technology, the aim is to develop the students' digital literacy skills in the direction of developing games for mobile devices and effectively using GIS applications, as well as skills related to the research, selection, analysis and management of information.

The learning objectives can be grouped as shown on page 10 (course description: learning objectives and outcomes).

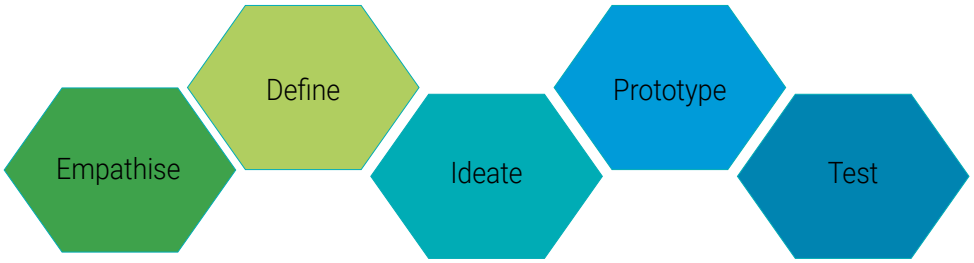


Figure 3. The 5 Stages of design-thinking.

3. Course outline

The theme: Create your own neighbourhood Olympics!
An "Olympics" theme is chosen, where people compete in different imaginary Olympic sports, exploiting opportunities to exercise their creativity and imagination as well as their body and mind.

The proposed outline can be adapted to the needs and the available time of the student group participating in the course. The sessions foreseen are 15, lasting 2 teaching hours each, of which 3 are field visits (longer than classroom sessions). The learning course is structured in 6 Stages, with an additional preparatory start-up Stage for the teachers who will participate in the course. The course stages are as follows:

Stage 0

Objectives
The „start-up" phase of the programme concerns the integration of the course in the school programme and the preparation of the participating teachers. The purpose of this stage is to consolidate the learning objectives of the course, to agree on the course structure and to identify the software to be used. Moreover, this stage aims to provide teachers with the basic skills they need in order to supervise the creation of a LBG. Upon completion of this stage, it is advisable that the participating teachers will have become acquainted with a very simple mobile location-based game, which they will demonstrate to students attending the course as an LBG example.
Description of activities
Decision to be taken by the school director and the teachers regarding how the course will be integrated in the school curriculum or optional classes (e.g. environmental education, optional afternoon courses).
Participating teachers study the present manual and familiarise themselves with the Siftr tool and the proposed LBG platform(s). They may also consult Annex 0.

Stage 1

Objectives
A central objective of this stage is to make students familiar with digital experiences in real space, introduce them to LBGs and demonstrate the potential of LBGs as a learning resource. Moreover, students will be encouraged to conduct an analysis of the urban space and learn to "read" its components and constituent features.
A second objective is to explain to students, using hands-on methods, the internal operation (mechanics) of a game and its components, which make a game interesting, challenging and educational.
A third objective is to introduce students to the Health and Fitness Itinerary concept, and guide them to create their own Itinerary in the vicinity of the school.

1.1 Introduction to the course and to the Health and Fitness Itinerary project

Proposed duration: 3 sessions (2 in the class and one in the field – to define the Itinerary)

Description of activities

a) Presentation of the course and introduction to the concept of the health and fitness itinerary.

Presentation of examples of existing Location-Based Games, e.g. play "Name-Animal-Thing" on the urban space categories, using smartphones

Physical and digital creation of working groups: creation of e-mails and working groups through file-sharing arrangements. Selection of mobile devices to be used.

b) Introduction to Siftr. Students develop familiarity with the app in the school yard.

c) Students undertake to design a "Health and Fitness Itinerary" in the vicinity of the school, using Siftr. In doing so, they become aware of the various features of open space (trees, pedestrian routes, furniture, water, low vegetation etc) and are guided to identify those features that can be used for physical exercise. They take photographs of all points of interest, to compose the Itinerary on Siftr. Annex 1 may be used to guide the students on the criteria for designing an Itinerary.

1.2 Learning the internal structure of a game in the school yard

Proposed duration: 1 session

Description of activities

Students are provided with very simple equipment (e.g. a long piece of string, plastic cups, hanging hooks, hula hoops, chalk, small balls, small round or flat stones) and are introduced to one or more simple games (see for example https://www.weareteachers.com/recess-games/ and similar sites for ideas).

After each game session the students discuss how the game can become more competitive, how the rules can become more meaningful, whether they can increase the number of players and so on. The students understand the importance of the rules, the necessary cooperation between players, the challenge posed by the game, how the game is won.

1.3 Learning to create new games by "hacking" known games

Proposed duration: 2 sessions

Description of activities

a) Students are introduced to game "hacking". "Hacking" games is making new games by modifying already known games through changing the rules, the scoring and the context, or mixing elements from different types of games, using equipment found in urban open spaces. Examples may include. monopoly, football, tennis, hide and seek, relay race, and many more.

b) Students are given the task to select games that can be hacked and played along the health and fitness itinerary, based on the scenario of the Neighbourhood Olympics. They undertake research on stories and careers of

popular Olympic athletes, drawing material from history and current events. As a result, they create a number of hacked games (5-6) making sure that they define the basic elements of game architecture (what is the rationale of the game? how is it played and where? Who wins and how? What is allowed and what is not?). Annex 2 may be used to describe on paper the games.

1.4 Field visit in the Health and Fitness Itinerary and playtesting the hacked games

Proposed duration: 1 session (in the field – along the Itinerary)

Description of activities

Students walk along the Health and Fitness Itinerary which they created and select locations to playtest the hacked games they developed. They are guided to make a good photographic record of these locations, using mobile phones.

Students playtest the games, discuss whether and how they can be improved, find out what works and what does not work. They also select locations that can host the improved games or locations that offer ideas for other fitness games; and make a photographic record of them.

Stage 2 **Objectives**

The objective of this Stage is for students to organize and discuss the material gathered with the appropriate tools, to learn about the digital tools for recording the route and to match digital material to actions on points of interest.

2.1 Familiarisation with maps, transfer the Itinerary on map

Proposed duration: 1 session

Description of activities

Students discuss in the classroom about the field visit experience and the worksheets. The session includes printing of the area map (e.g. using google maps), familiarisation with maps; and identifying the selected points of interest on the map, as well as defining the game area around each point of interest.

Students also discuss the opportunities offered by the Itinerary in relation to physical exercise and the games hacked

Stage 3 **Objectives**

The objective of this Stage is to introduce students to the digital design environment of a LBG. At the same time, students are invited to create the narrative and the scenario of the game, define the game structure and the game components and create the content of the game.

3.1 Introduction to game design components, preparation of back story and scenario

Proposed duration: 2 sessions

Description of activities

a) Students are introduced to the basic structural elements of game design. Aim, backstory, scenario, rules, scoring, rewards, number of players, non-playing characters, and they start developing the Location-Based Game.
Recommended actions:

- Brainstorming for the game scenario and the mini-games to be included in it, using post-it stickers.
- Putting the ideas in order and selecting roles for the students.
- Creation of subgroups of students to develop different aspects of the game.

b) Creative writing of scenario and mini-games in sub-groups.

3.2 Game structure in the design platforms

Proposed duration: 1 session

Description of activities

Teachers make a detailed presentation of the game development platform selected.
Students become familiar with the platform and discuss how they should present their scenario and mini-games on the platform
3.3 Develop the game structure and content
Proposed duration: 2 sessions
Description of activities
Students work further on the scenario and the mini-games. Develop the storyboard (logical steps of the scenario) and present an overall game plan document.
Further actions recommended:

- Shared digital working folders amongst the team members are created.
- Media like audio, photographs, video, cartoons, drawings etc are introduced in the mini games and the other parts of the game (introduction, dialogues with non-playing characters, instructions, scoring rules etc).
- Siftr, Geotagging, recording the itinerary, installing the necessary applications (LBG platform) in the mobile devices. Testing in the school yard.

Stage 4 Objectives

This stage is at the core of game development, and may need additional homework by students. The objective is to place the original material inspired by students in a digital experience format using the selected platform. Emphasis is placed on choosing the appropriate gaming mechanisms in relation to how the game can be reproduced through player interactions with the mobile device (e.g. instructions, missions, team

selection, individual platform features).

4.1 Game development on the selected platform

Proposed duration: 2 sessions (additional homework is recommended)

Description of activities

Students work on the platform and connect the scenario with the game's core elements - i.e. introductory and mini-game texts, dialogues with the game characters, imaging, video, artwork, making clear the aim of the missions (mini-games) and the scoring.

Remote testing in the classroom and solving problems through re-designing and modifications are recommended. Feedback is provided by the teachers.

Stage 5

Objectives

The purpose of this Stage is to test the game on the ground, to identify problems that may arise in the physical space and to regulate its parameters in order to have a better flow as an experience in the field.

5.1 Playtesting visit

Proposed duration: 1 session (in the field – along the Itinerary)

Description of activities

Students undertake to playtest the game in the field, along the Itinerary they have defined during the initial sessions of the course.

Features that need attention:

- Mini-games' timing,
- Game mechanics,
- Players' motivation,
- Suitability of the mini-games' environment,
- Obstacles (natural, manmade, technological etc).

5.2 Game adaptation

Proposed duration: 1 session

Description of activities

Students adapt the content, core game elements, game mechanics and the ways of interaction between the mini-games and the players. If necessary, new game elements are introduced and existing ones are discarded.

Remote testing is undertaken in the classroom and problem solving is achieved through re-design and modifications.

Stage 6

Objectives

The objectives of this Stage are multiple: to conduct an evaluation of the game, by inviting other people to test it (outside the group that created it); to refine the game if necessary; to conduct an evaluation of the course itself; and to communicate students' work to the local community in order to highlight the students' achievement and to promote the game to the public.

4. Evaluation of the course and the game

Proposed duration: 1 session
Description of activities
a) Assessment of the game experience by other players (e.g. other students who had not taken part in the course), regarding:

- Friendliness and clarity of the game (e.g. clear instructions, clarity of the objectives of the mini-games and their implementation)
- Visual quality of the game screens
- nterest and motivation aroused to players
- Adequacy of the game mechanics (e.g., how scoring is defined, rewards are given)
- Change of the player's attitude regarding the improvement of health and fitness in a public open space.

As a result, fine-tuning of the game may be necessary.
b) Assessment by the students who took part in the course through an online evaluation questionnaire (see Appendix B.3).

6.2 Presentation of the game to a local audience
Proposed duration: 1 session (open to the public)
Description of activities
Students make a final presentation of the game to the school community and the local community.

5. Conclusion

The students' learning experience was overall positive and they were really interested in the topic and the course activities, however students stated they wish they had more time to dedicate in working for the course activities. Unfortunately, their school workload was heavy and some of them even found it hard to attend in some of the course sessions. This created additional stress to the management of the course and the work needed to complete the course activities. Moreover, although most course work took place during the scheduled sessions in the class or on the field trips, the students also needed to work from home especially during the activities of Stage 3 (building the game scenario and developing the game texts like information, instructions an dialogues) and Stage 4 (developing the game on the TaleBlazer platform).

A very positive change in the students' perceptions and attitudes was also recorded, regarding the role of green and blue infrastructure in promoting health and wellbeing among the citizens. This positive change in perceptions and attitudes is especially evident regarding the link between the urban green and blue infrastructure and physical exercise, as well as the importance of this infrastructure's role in the everyday life of citizens. It is also important to note that the students reply they are now in a much better position to identify opportunities for physical exercise in an open space that they had never thought of before.

You can find more detailed information and experiences about the imparted course in the report Adapting the PREHealth education tools for use in secondary schools (Mylonas & Papageorgiou, 2019).

Part 2:

Manual for teaching a location-based game design course in higher education

1. Course description
2. Learning objectives and outcomes
3. Course outline
4. Evaluation of the course
5. Practical advice on the development of the course
6. Conclusion LBG adapted for higher education students and potentials

Marianne Halblaub Miranda, Gladys Vásquez Fauggier, Martin Knöll

1. Course description

Discipline	Urban design and architecture
Workload	5 ECTS (150 hours)
Duration	1 Semester
Course format	Project work
Course content	Participants will: • learn, research, and report about the relation/interaction between green and blue infrastructure (green open spaces and water elements) and users' behaviours, • formulate motivation, objectives, methodology, evaluation, results, and conclusions as independently as possible (depending on target group), • learn and apply digital tools for analysing and sharing information about open spaces in their own city, • learn to use digital tools for designing and developing games, • adapt a given game concept to their local needs and own game ideas, and • apply/transfer the acquired knowledge to develop/create a location-based game (LBG) to encourage physical activity and social interaction in urban open spaces
Learners' background	Bachelor or Master student from urban design or architecture
Equipment	In addition to the equipment listed in Appendix A, students will need sketching and mapping material commonly used in the discipline
Teachers' skills	In addition to the skills listed in Appendix A, the course should be led by an urban design lecturer with knowledge about urban design, analysis, and development.

2. Learning objectives and outcomes

Definition of scope and setting the basis

To learn and understand the importance of blue and green infrastructure in the urban environment and for city dwellers' physical and mental health

To understand and acknowledge that the active use of open spaces can positively influence the mental and physical health of city dwellers

To learn and understand the potentials of LBG for informal learning about one's health and well-being while actively using urban open spaces

To develop a research mentality, as well as critical and creative thinking about the use of public spaces in promoting health and physical exercise

To formulate (as independently as possible): motivation, objectives, methodology, evaluation, results, and conclusions

To learn about urban design that actively promotes users' health

Analysis

To learn about and apply digital tools for analysing and sharing information about open spaces in own city

To research, collect and analyse data, and carry out assessment and synthesis work within the analytical framework of physical activity and social interaction in urban open spaces

To organize and evaluate the material collected in the field (photos, videos, etc.)

To identify potentials and weaknesses to promote health related activities in the area of interest

Identify potentials and weaknesses to promote health related activities in the area of interest applying urban analysis tools together with other (digital) tools

To understand the relationship between the urban environment, especially urban open spaces, and citizens' behaviours

Game design and concept	To learn about game design To build a simple scenario and story of a location-based game. To engage in creative writing/sketching and build a simple scenario for a LBG To discuss, collaborate and participate in a creative process. To derive information about the open space through field and desk research and relate these to the content of the game storytelling To select appropriate software for collecting and editing material for game content
Game development	To develop a digital game for mobile devices using ICT tools. To explore use of digital media and instructional resources for learning
Testing prototypes and final game	To test the resulting prototypes and game with users of the open space To carry out an evaluation on site during prototype testing and after the game testing To document and incorporate evaluation results from the prototype testing in to the further development of the game
Report and present	To document and reflect upon evaluation results from the game testing To present final results (written, oral, and drawings/sketches/models/mock-ups as commonly used in the discipline)

Further competencies and skills	To discuss and debate a variety of issues, showing respect for different views
	To develop a spirit of cooperation and responsibility
	To adopt good practices with regard to the use of mobile devices
	To raise awareness on the issue of health and physical exercise in the city resulting in a positive attitude towards health-related activities
	To encourage others (friends, family, neighbours) to actively use the urban public space and actively participate in its improvement
	To be able to propose improvement to the urban open space, especially green open spaces, and understand affordances that promote physical exercise

3. Course outline

The course addresses urban design and architecture students, enrolled in bachelor and master programs. The participating lecturers and organizers have designed an integrated course program where the teacher(s) and students can meet once a week or every second week and discuss the objectives in different formats, combining lectures, workshops, student team projects and advisory sessions.

The presented course has the duration of one semester, which can vary between 12 and 16 weeks between summer and winter terms.
The tasks to complete the course successfully are:

- Defining the goals and scope of the project
- Analysis of a chosen open space using digital tools on site as well as urban design analytical tools
- Further developing the original concept of the game "Neighbourhood Olympics" (proposed in IO5) with original and creative ideas
- Game design (game goals, dynamics, and mechanics) and creation of graphic material
- Prototyping
- Testing
- Documenting (photos, maps, reports, etc.)
- Evaluation
- Presenting final results

Stage 1: Defining the scope

Input	What are LBGs, what are game mechanics, dynamics and goals. Some examples.
Task	Students research some games, identify the components and discuss their findings in plenum.
Tool	The teacher could have a list of relevant and current games (for a few examples, see page 15 *Examples of LBG*) for the goal to choose from. Otherwise, students should research on their own (internet, library, etc.)
Format	Depending on the number of students, the example games can be analysed in groups. Ideally about 5-8 games can be analysed and discussed.
Duration	2 weeks
Evaluation and expected result	Presentation and discussion of the analysed games. Reflection upon which components could be relevant for achieving their goals.
Requirements for the teacher	Understand game design components and be familiar with some games

Stage 2:	**Analysis of the chosen open spaces (Health and Fitness Itinerary[1])**
Input	Presentation of: green and blue infrastructure in urban areas; implications of urban design elements on human health and well-being; active usage of urban spaces.
Task	Go to the area of interest and identify potential areas to be used actively and collect examples on how-to. In addition, map existing and well-functioning areas.
Tool	Siftr.org for data collection
Format	Working individually
Duration	2 weeks
Evaluation and expected result	Presentation of the results and finally a collective map of the area of interest showing potentials and weaknesses in relation to the active usage of the spaces.
Example	Siftr map developed during the course in summer semester 2019: https://siftr.org/PREHealth/
Requirements for the teacher	Explain the importance of green and blue infrastructure in urban design and planning, sketch out their relationship with health and well-being[2]. Be familiar with Siftr and able to guide the creation of the map.

Stage 3:	**Design (adapt) a game concept for the chosen location**
Input	Presentation of: Concept for a location-based game developed in IO5 – "Neighbourhood Olympics".
Task	Further develop the given concept for a LBG with a creative idea adapted to the city and chosen location. Write a backstory, define game mechanics and dynamics, and start developing graphic material to convey the game aesthetics
Tool	Not specified. Can be chosen freely, e.g. sketches, storyboards, digital mock-ups, collages, etc.
Format	Working in groups of 2 or 3 people

1 See explanation of the Health and Fitness Itinerary on page 27

2 For literature review see Halblaub Miranda et al., 2019

Duration	2-4 weeks
Evaluation and expected result	Any material that can be used to explain the concept, a backstory, and first ideas about game dynamics and mechanics. First graphic material showing the envisioned game aesthetics.
Example	**Game:** Mars Mission **Student:** Ece Enüllu

Concept:
The ESA (European Space Agency), based in Darmstadt, is planning their first manned exploration to mars. In order to be prepared for the challenges, prospective astronauts must be made aware of the physical requirements and train their bodies in open spaces before going to the next stage of their training.

Game dynamics:
Players are given the role of prospective astronauts of the ESA's space program and receive their training instructions by a virtual assistant, called Thea. The player must fulfil 8 tasks, called "stations" in the game, in different locations of the open space, often using existing elements of the built environment for the activity. Upon completion, the player will be rewarded and the achievement will be placed in her inventory.
The game can be played by one player as well as by multiple players under the mode "training as a crew". The missions are designed to fit either one player or more. Either way, interactions with other players is encouraged during the game.

Game mechanics:
Players are guided through graphic and audio elements. The player must log when they have successfully mastered a task to go to the next one.

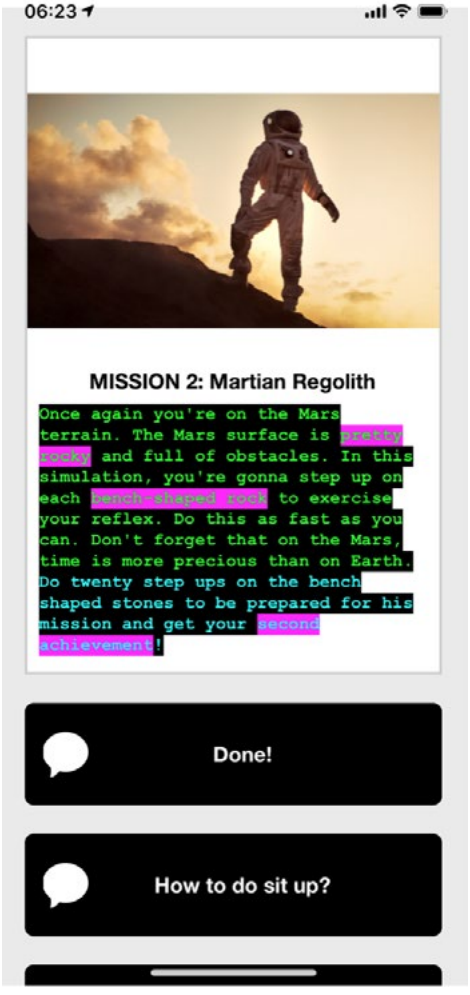


Figure 4. Screenshot of the game. Source: Ece Enüllu

Stage 4:	Develop a prototype of the LBG in the TaleBlazer platform
Input	Presentation given by an expert in TaleBlazer: first steps on how to create a LBG. Alternatively, teacher can learn about the platform here (Mylonas et al., 2019) and here (TaleBlazer, Resources for educators – online)
Task	Learn how to create a LBG in TaleBlazer. Start programming the LBG in the TaleBlazer platform. Verify of the envisioned mechanics and aesthetics can be implemented with this platform.
Tool	TaleBlazer
Format	Workshop - Hackathon
Duration	6 hours
Evaluation and expected result	First implemented steps/tasks of the game in TaleBlazer. Game interaction and dynamics may need to be adapted due to the constraints of the platform (see 5. *Practical advice*).

Stage 5:	Further develop the prototype of the LBG in the TaleBlazer platform
Input	Supervision and support by an expert in LBG and TaleBlazer
Task	Further develop the prototype of the LBG in TaleBlazer
Tool	TaleBlazer
Format	Workshop - Hackathon Discussion and Q & A sessions about the platform
Duration	6 hours Workshop + 2 weeks more on their own to finalize the game
Evaluation and expected result	Finalizing the programming of all steps/tasks of the LBG in TaleBlazer

Stage 6:	Testing first prototypes of the LBG on site
Input	Peer feedback
Task	Go on site and test the game with the teacher and the other students.
Tool	TaleBlazer
Format	Testing on site – Peer feedback
Duration	4 hours testing on site + 2 weeks more to do corrections and improvements
Result	Testing on site

Stage 7:	Testing the LBG on site with users
Input	Questionnaire to gather feedback of the LBG Prototype (See Appendix C.1 or C.2)
Task	Go on site and test the game with the target group (at least with 10 other people) and ask for their feedback.
Tool	TaleBlazer + Questionnaires
Format	Testing on site – Users feedback
Duration	4 hours testing on site + 2 weeks more to do corrections and improvements
Result	Testing on site with the users + 10 answered questionnaires by users

Stage 8:	Final presentation
Input	-
Task	20 min presentation of each game including all the stages of the course.
Tool	Not defined
Format	Presentation with direct feedback from teacher, peer feedback is encouraged
Duration	20 min presentation of each game + 10 min questions/ comments
Result	A final presentation including the results of all the stages A written report with detailed information about all the stages of the course

If there is a possibility to present the games to a broader audience (e.g. as part of a participatory planning event in a local open space), we recommend a Stage 9: Public presentation. This can be combined with Phase 7 or can be a stand-alone event, in which students present their game ideas and offer playtesting their prototypes with participants.

See our experience with students presenting their games as part of a multiplier event in Darmstadt (in German):
Newspaper article: https://www.echo-online.de/lokales/darmstadt/darmstadt-mit-der-app-mehr-bewegen_20137028
Description of games and impressions of the event: https://prehealth.eu/digitale-stadtspiele/

4. Evaluation of the course

There are two types of evaluation:

1. Student performance (done by the teacher): for this evaluation please see Appendix B.1, which contains a form with five criteria to evaluate student's work
2. Course evaluation (done by the students): for this evaluation see Appendix B.2 or B.3, which contains several questions regarding the success of the course and possible improvements that can be done in the future.

5. Practical advice on the development of the course

Regarding the selection of the area to work with:

It is necessary to select an area, which will be the scenario of the game. It is recommended to pick an area under the following criteria:

- It contains urban open spaces, green and blue infrastructure
- The size of the area is not specified, although is recommended to use a space bigger than 0.1km2
- The location of the area is not specified, although is recommended that should be accessible to as many users as possible
- Ideally the area is easy to walk, jog and perform some physical activity
- Ideally the area offers WiFi (not mandatory)

Regarding the time plan:

- If the course is carried out in a region with seasons, ideally it should be carried out in the spring / summer semester since the students need to carry out various previous tests on site and with users they find there.
- The course has been carried out with supervision sessions both every week as every two weeks. If the capacity is there, it is recommended to have sessions every week in order to have a continuous process with the students.

Regarding technological issues:

- It is ideal to have a teacher with background in urban planning and/or information technologies
- It is recommended to have several workshops or inputs from other disciplines (e.g. sport sciences, psychology, graphic design, etc.)
- TaleBlazer is a free available platform to create a LBG. Nevertheless, it is recommended to use more sophisticated platforms (e.g. ARIS) in order to obtain more visually attractive results.

6. Conclusion LBG adapted for higher education students and potentials

Teaching a location-based game design course in higher education as part of an architecture and urban design curricula offers both challenges and benefits. Some of the challenges are common to interdisciplinary teaching formats. For the teachers, the challenges involve a plus in organizational tasks, e.g. arranging inputs from colleagues from other disciplines or making time for longer advisory sessions for the students, allowing more questions and one-on-one guidance. For students, this course requires likewise extra engagement as they have to be willing to learn basics skills and the language from different disciplines (e.g. game design), they have to become familiar with the platform to design a game and learn and conduct project management skills (e.g. when organizing the testing with citizens on site). The benefits for students lie in the possibility to design and develop functioning prototypes and a final LBG which is based on the interaction with the built environment at the scale of an open space or even neighbourhood. All LBG were tested on site with users, who would interact with the built environment and become active following the student's game and interaction concept. This course allows students to observe reactions to their concept and design (e.g. questions, hesitations, enjoyment of becoming active in a green space by test persons) within the 12-16-week time frame. This is a rare opportunity in urban design, where projects usually get realized within the time frame of years. Due to the nature of a LGB (i.e. being digital but being played in the city) this course can offer students learning new techniques of testing and user evaluation, too, which are otherwise rarely taught in architecture curricula.

You can find more detailed information and experiences about the imparted course in the report Creating a Location-Based Game: The experiences of higher education students (Vásquez Fauggier & Pfeffer, 2019).

PART 3:

Self-learning manual for adults on how to design a location-based game

1. Learning objectives: for whom do we offer the self-learning package?
2. Introduction and preparatory work
3. Presenting the adult learning course: stages of the game-development
4. Example of a scenario outline and an LBG: How to play? What to gain?
5. Summary, evaluation results and practical advice for future design

Patrícia Honvári, Irén Szörényiné Kukorelli

This part of the Manual gives a short introduction to a self-learning package, presenting the topics and chapters that are covered by the learning material. The self-learning package compiled by the Széchenyi István University guides adult participants working both in a formal or in an informal learning environment.
The self-learning package is available on the following link in two languages (English and Hungarian): http://rs1.sze.hu/~corona/irennek/
If you are interested in the complete course, please visit the web link provided, and see the content in detail.

1. Learning objectives: for whom do we offer the self-learning package?

The game concept of PREHealth aims to motivate and mobilise citizens, in order to use the public open spaces more actively for their health preservation. Through the game, players will be motivated to perform physical activities, while maintaining the mental health is also a priority. The guide will help adult learners, showing step-by-step how they can design a location-based game on their own, in the frame of an informal or a formal course.

Not only the game development itself can be considered as a goal, but the education of the target groups as well. To make public space users understand the importance and possibilities of urban open spaces is also a highlighted goal. In order to achieve these goals, a location-based game was selected as a tool, which has to be motivating, stimulating, creative and enjoyable.

By using the self-learning package, learners will be able to:

- To understand and acknowledge that the blue and green infrastructure is able to positively influence the urban environment.
- To understand and acknowledge that the active use of open spaces can positively influence the mental and physical health of city dwellers.
- To acknowledge the features, facilities and multifunctionality of open spaces.
- To understand and develop the relation between the urban open spaces and the health, well-being of city dwellers.
- To develop a critical and creative thinking about the use of urban open spaces, and the promotion of health and physical exercises in them.
- To understand and acknowledge the possibilities of certain open spaces regarding health-preservation.
- To organise the material collected in field (photos, videos, etc.)
- To research, collect and analyse data, and carry out assessment and synthesis work through exploring the issue of physical exercise in the public spaces.
- To build a simple scenario and story of a location-based game.
- To design a digital game for mobile devices using ICT tools.
- To develop the digital competences in general.
- To develop the attitude of working in a team and cooperation.
- To discuss, collaborate and participate in a creative process, and develop a respect for different views.
- To raise awareness on the issue of health and physical exercise in the city.
- To encourage others for the active use of open spaces.
- To propose solutions to improve the urban open spaces, by promoting opportunities for physical exercise and health-preservation.

As it is visible, learners gain several learning outcomes, while skills acquisition are also expected. Due to the long list of learning outcomes, there is a high potential for exploitation. We strongly advise the use of the self-learning package to the following groups:

- adult education groups with a focus on regional development, urban planning and development, urban design, sport and physical activities, health preservation and recreation (formal education),
- informal adult groups (NGOs, self-learners, civil organisations) focusing on the above issues,
- educators of adult education, adult education organisations and developers of the curricula, and
- citizens, wide-public and interested parties, caring for their urban environment, wanting to learn and wanting to design a creative game for city dwellers.

The self-learning manual contains 5 main chapters, containing 5 sequential learning blocks, from the introduction of the topic, to the game-design and location-based game mechanics. In the following section, this manual will shortly present the content of each of the learning chapters, focusing on the main learning outcomes and structure of the course.

2. Introduction and preparatory work

The first part of the learning package contains an introduction on *the topic*: physical activities and the open spaces. As a first step of the learning course, it is important to make participants aware of the fact, that the active use of urban open spaces can positively influence the health of city dwellers, especially when it comes to physical activities or recreation.

You will be able to learn about the relation between health-related behaviour and urban open spaces (green spaces, squares, street networks, blue infrastructure). By all means, it is a fact, that there is a need for intervention both on individual and on community level, and a supporting environment assisting the healthy lifestyle needs to be established. Especially in urban environments has the demand for healthier cities appeared, and there is a growing need for the elaboration of different public places and open spaces that can be used for sports and active recreation.

In chapter 1 you will be able to find out more, based on a national literature review and good examples. Adult learners will be able to understand and acknowledge the features of open spaces and how they can contribute to the health and well-being of urban dwellers. (Suggested learning time: 1-2 sessions.)

As a second step, it is advisable to select an area, a so-called "health itinerary". The health itinerary means the network of selected open spaces within the city, which gives physical place to the location-based game. The itinerary not only includes the open spaces (parks, green areas, blue infrastructure, etc.) but also the linkages between them (routes). There are several criteria to select such an itinerary:

- It should be easily accessible for everyone (include open, public spaces).
- It should be suitable to promote health (physical activities, active travel and/or social interaction).
- In order to reach a wider audience, the itinerary should contain attractive/ central spaces.
- The itinerary should include spaces, where different infrastructures are available regarding the needs of the target group.

Furthermore, when selecting the health itinerary (i.e. the location of the future game), it is also important to make some preparatory work on certain open spaces. For this, a good idea is to make a field visit, and fill in some questionnaires with open space users. Who are using the open spaces? What are the patterns of behaviour, why do people go and visit open spaces? Do they perform activities for their health preservation? The answers to these questions can provide an in-depth analysis about the current state and usage of open spaces, finding the gaps. In Chapter 2 you can read about the determination of the health itinerary, as well as you can also learn, how you can make such an evaluation on the open spaces with an example of a questionnaire-survey.

The introduction and preparatory work form are an integrated part of the learning course, preparing adult learners for the actual game-development. (Suggested learning time: 3-4 sessions.)

3. Presenting the adult learning course: stages of the game-development

Chapter 3 of the learning package will present the in-depth method of game-development, focusing on single game-design stages. Throughout the process, it is important, not to forget the aim of the learning course: to design a location-based game that is able to activate and mobilise citizens for the more active use of urban spaces.

The adult education course is divided in 9 stages, as follows:

1. Writing a backstory, collecting ideas and create a narrative: having an overall backstory will help the location-based game designers to create a narrative, and later on, the characters of the game.
2. Finding the locations: field visits and collection of data: field visits are integrated parts of the location-based game development course, since these give the opportunity to link game ideas with concrete physical places.
3. Overview of illustrations: brainstorm on game challenges
4. Brainstorm on characters/players and dialogues: filling the game with characters will make it enjoyable.
5. Creating the scenario and the game concept: finalising the rules, game architecture, goals, requirements, etc.
6. Selecting the location-based game platform: the place where all the ideas can be brought together.
7. Preparation of game illustrations: photos/drawings/videos/audio, etc.
8. Game-design and draft version: editing the game on the platform
9. Testing and final adjustments: playtesting on field to see, what works and what doesn't, and how to improve it.

To all of the above steps, the learning package provides descriptions of sessions and concrete examples. It is important to emphasize, that the suggested location-based game platforms (editors) are easy to use and do not demand complex IT-knowledge. Beside the learning package, several tutorials, manuals are also available online regarding the selected platforms. Participants can simply use the learning-by-doing method, and explore the possibilities themselves.

However, the learning package will give instructions on how to access LBG and AR applications and design platforms. The biggest emphasis is put on the TaleBlazer platform (http://taleblazer.org/) and Siftr application (https://siftr.org/). The self-learning package will also give advice on how to create game architectures, goals, rules, challenges, dialogues, or assets. (Suggested learning time: 1-2 session per stages.)

4. Example of a scenario outline and an LBG: How to play? What to gain?

The next chapter of the learning package will present an example of a game created in the frame of PREHealth methodology. Chapter 4 will present the location-based game called the "Győr Health Itinerary", which is available on the TaleBlazer platform, with the game code "gyfipvo". In order to play outside the location and to activate the tap to visit option, you will need to use the "prehealth" password.

The main concept of the game is to promote physical and mental activities, while people walk through certain public spaces and parks within the city. Players will find short videos, where active sportsmen of Győr and other public figures show either physical activities or offer quizzes for preserving mental health. Players can also choose from different routes; at the moment, there are 4 itineraries available, designed according to the needs of different target groups. The first 2 are mainly created for the seniors, contain easier physical activities, and more quizzes, intellectual challenges and information about different cultural heritage of the city. The third one was mostly designed for families and youngsters; however, it can also suit elders, with a little more intense physical activities, but also with quizzes. And finally, the fourth route is mainly directed to those, who are engaged with physical activities and looking for more intense activities.

Altogether, there are 5 different game-elements, these are what players can come across, when playing the game:

- Videos on promoting physical activities: active or former sportsmen and athletes of Győr are showing, how to perform physical activities on selected open spaces.
- Instruction on physical activities: Beside the videos, concrete instructions on physical activities can also be found along the routes.
- Videos on intellectual challenges: famous public figures/artists present selected open spaces, share information on their culture/history and raise a question, that the player needs to answer in 15 seconds.

- Interesting facts/points of interests on cultural heritage and history: at several spots, interesting facts and information is shared regarding the cultural heritage or history of the city, connecting to the given open space.
- Interesting facts/info-sharing on health issues: at several spots, interesting facts and information is shared regarding health issues.
- Quizzes: All of the quizzes are in connection with the given open space, furthermore, in many cases the answers can also be found, when players look around.

The game-play can serve as an example for adult learners' groups to create their own game. By downloading the game and making a play-through, participants can also get familiarised with the appearance of a TaleBlazer game, getting inspiration and ideas.

5. Summary, evaluation results and practical advice for future design

The self-learning manual is based on the experiences of a pilot program, including 10 adult learners from January – June 2019, with the aim to create a location-based game (the "Győr Health Itinerary"). After finishing the course, participants also evaluated the process, and shared their experiences. When completing a learning course (being formal or informal), it also very important to make an assessment, and measure and survey the learning outcomes. Chapter 5 of the self-learning package will give a guide on how to evaluate the process, providing also an evaluation framework and a possible questionnaire to measure the results.

Based on the experiences in the city of Győr, the following comments can be made on the adult education process:

- Consistent opinion of the adult learners' group is that the pilot process was successful, and the set objectives could be reached.
- Pilot participants enjoyed the process and had positive experiences. They liked working in the pilot environment and enjoyed the creative and mutual learning. They also emphasized that the compilation of the group was excellent, having also a chance to widen their networks. Further positive remarks were also made on the cooperative atmosphere, and that everyone's ideas have been heard and respected.
- Naturally, some negative experiences and difficulties have also been mentioned. It was expressed as an obstacle, that not everyone could join all of the meetings. As a consequence, it was also mentioned that

maintaining the interest and interactive participation took a lot of effort. Furthermore, participants also stated that in some cases the decision-making took a serious amount of time. However, this was also due to the complexity of the task, and that participants had no previous experience in game-design.

- All of the participants stated that the pilot process of adult learning and the PREHealth methodology is adaptable, and can be repeated in different settings and organizations. Although it was also stated, that a bigger emphasis should be placed in the beginning of the process on the cognition of the location as well as on the technical/technological features of the game-design platforms.

Regarding the learning outcomes, adult learners were able to understand and acknowledge that the active use of open spaces can positively influence mental and physical health, and that the blue and green infrastructure is able to positively influence the urban environment. They have developed a critical and creative thinking about the use of the urban open spaces, by determining activities playable on site. Furthermore, participants also developed digital competences, they have used Siftr application, collected material in field, reviewed and analysed them. They have also learned about location-based games, and LBG platforms, were able to select the most suitable one, learned how to place characters and agents, what features it has (what can player see during the game play, how they "bump" in each of the characters, etc.). Participants learned how to discuss and express their view, also considering the opinion of other members, developed their attitude of team-work and cooperation. Furthermore, a high emphasis was also put on attitudes regarding the topic of the project, and participants learned how to raise awareness on the issue of health and physical activities within the city, and to encourage others for the active use of open spaces.

To sum up, through the adult learning process, the desired outcomes can be reached, and with the help of the self-learning package, adult groups can design their own game, also gaining the benefits mentioned above.

You can find more detailed information and experiences about the imparted course in the report Creating a Location-Based Game through informal learning: The experiences of the adult education in Győr (Szörényiné Kukorelli & Honvári, 2019).

PART 4:

Manual for teaching a location-based game design course for chronically ill children

1. Course description
2. Learning objectives and outcomes
3. Course outline
4. Evaluation of the course
5. Practical advice on the development of the course
6. LBG design platforms and AR tools adapted for chronically ill children and their potential

Remco Veltkamp

The context of this course material is the development of a location-based game, in a co-creation development cycle with chronically ill children with other actors and stakeholders. Because of potential somatic and mental limitations, the role of the chronically ill children in development of the game is balanced with the role of higher-education student who takes the final responsibility in the building of the game.
The following first tier actors are involved:

- Children: a school class of chronically ill children
- Developer: bachelor or master thesis student, or student assistant

The following second tier stakeholders are involved:

- Teacher: the school teacher
- Legal representatives: parents or carers
- Care givers: paediatricians
- Game designer: an experienced game designer to consult
- Supervisor: student supervisor

The objective of the course is to empower disadvantaged groups of chronically ill children. The course aims to promote active citizenship in this disadvantaged population, by using mobile games as interactive mechanisms allowing disadvantaged populations to take a more active role in the design and monitoring of open spaces and increase awareness in how these open spaces can contribute to health and well-being.

1. Course description

Learner (target group)	Higher education students	Chronically ill children
Teacher (course developer)	Higher education teachers	Bachelor or master thesis student, or student assistant
Discipline	Computer science	-
Workload	5 ECTS (150 hours)	-
Duration	10 weeks	
Course format	Project work	
Course content	Participants will: • learn, research, and report about the relation/interaction between green and blue infrastructure (green open spaces and water elements) and users' behaviours, • formulate motivation, objectives, methodology, evaluation, results, and conclusions as independently as possible (depending on target group), • learn and apply digital tools for analysing and sharing information about open spaces in their own city, • learn to use digital tools for designing and developing games, • adapt a given game concept to their local needs and own game ideas, and • apply/transfer the acquired knowledge to develop/create a location-based game (LBG) to encourage physical activity and social interaction in urban open spaces	
Learners' background	Bachelor, Master student or student assistant from computer science	-
Equipment	As listed in Appendix A	-

Teachers' skills	In addition to the skills listed in Appendix A, the course should be led by a computer science lecturer with knowledge in game design and development	The student must be able to communicate the goals and tasks clearly to the children as well as be able to gather their feedback in such a manner, that it can be useful for the further development of the game

2. Learning objectives and outcomes

	Higher education student	Chronically ill children
Definition of scope and setting the basis	To learn and understand the importance of blue and green infrastructure in the urban environment and for city dwellers' physical and mental health To understand and acknowledge that the active use of open spaces can positively influence the mental and physical health of city dwellers To learn and understand the potentials of LBG for informal learning about one's health and well-being while actively using urban open spaces To develop a research mentality, as well as critical and creative thinking about the use of public spaces in promoting health and physical exercise To formulate (as independently as possible): motivation, objectives, methodology, evaluation, results, and conclusions	

	Higher education student	Chronically ill children
Analysis	To learn about and apply digital tools for analysing and sharing information about open spaces in own city To research, collect and analyse data, and carry out assessment and synthesis work within the analytical framework of physical activity and social interaction in urban open spaces To organize and evaluate the material collected in the field (photos, videos, etc.) To identify potentials and weaknesses to promote health related activities in the area of interest	To learn to self-reflect on their illness-related needs
Game design and concept	To derive information about the open space through field and desk research and relate these to the content of the game storytelling To select appropriate software for collecting and editing material for game content To implement the co-creation process with other actors and stakeholders in a timely, transparent, and responsible way.	To learn about game design To build a simple scenario and story of a location-based game. To engage in creative writing/ sketching and build a simple scenario for a LBG To discuss, collaborate and participate in a creative process. To experience giving constructive input to the design of the location-based game.

	Higher education student	Chronically ill children
Game development	To develop a digital game for mobile devices using ICT tools. To explore use of digital media and instructional resources for learning	To learn to critically think about the experience of co-creating and playing the game
Testing prototypes and final game	To test the resulting prototypes and game with users of the open space To carry out an evaluation on site during prototype testing and after the game testing To document and incorporate evaluation results from the prototype testing in to the further development of the game	To experience play testing of the resulting game
Report and present	To document and reflect upon evaluation results from the game testing To present final results	
Further competencies and skills	To discuss and debate a variety of issues, showing respect for different views To develop a spirit of cooperation and responsibility To adopt good practices with regard to the use of mobile devices To raise awareness on the issue of health and physical exercise in the city resulting in a positive attitude towards health-related activities To encourage others (friends, family, neighbours) to actively use the urban public space and actively participate in its improvement	

3. Course outline

The whole course takes place in a period of 10 weeks. The idea of developing a location-based game thus is that chronically ill children learn by co-creating and play-testing a game. Adding the important feature of user-created games enables the process of game construction to become part of the educational process.
From several interviews held with the stakeholders, it became clear that the main problem these chronically ill children experience is social exclusion. These children at a higher risk of feeling lonely, not being part of a group, and be excluded in social activities. This especially occurs when these ill children want to interact with non-ill children in a normal environment, like their primary school.
The process in the co-creation of the location-based game consists of the following phases.

Stage 1:	Analysis of the active usage of public space
Input	Current situation and near future plans for reconstruction of the area for the location-based game
Task	Student: go to the area of interest and identify potential areas to be used actively and collect examples on how-to. Interview stakeholders, including the children.
Tool	Camera and notebook
Format	The student works individually, interviewing paediatricians and children.
Duration	2 weeks
Evaluation and expected results	Student: presentation of the area and selected locations for the actions in the LBG Children: active participation

For example, in Utrecht a location has been chosen between the Wilhelmina Child Hospital and the Fritz Redle school. This is the planned Child Health Campus, see figure 5.

Figure 5. Child Health Campus location in Utrecht.

Stage 2:	Instantiation of the theme of the location-based game Olympic Games in the City
Input	Presentation of the concept for a location-based game developed in IO5 – The Olympic Games in the City
Task	Student: further develop the given concept for a LBG with a creative idea, write a backstory and start developing graphic material Children: active participation in interview
Tool	Not specified
Format	Iterative document design, in consultation with stakeholders: children, school teachers, parents/carers, paediatricians, game designer
Duration	2 weeks
Evaluation and expected results	Student: presentation of the specific choices for: Theme (e.g. missing athlete at GameOlympics) Narrative (e.g. players help detectives to find missing athlete) Game elements: goal, rules, challenges, dialogues, assets Children: active participation

For example, in Utrecht the LBG GameOlympics has been developed, situated in the Child Health Campus area.

Figure 5. Instantiation of the Olympic Games in the City in Utrecht: GameOlympics.

Stage 3:	Start programming and developing a prototype
Input	TaleBlazer tutorials online, http://taleblazer.org/Support/documentation
Task	Learn how to create a LBG in TaleBlazer. Start programming the LBG in the TaleBlazer platform
Tool	TaleBlazer
Format	Iterative programming, testing, demonstrating
Duration	2 weeks
Evaluation and expected results	Student: a working prototype that shows some functionality at each of the locations of the LBG

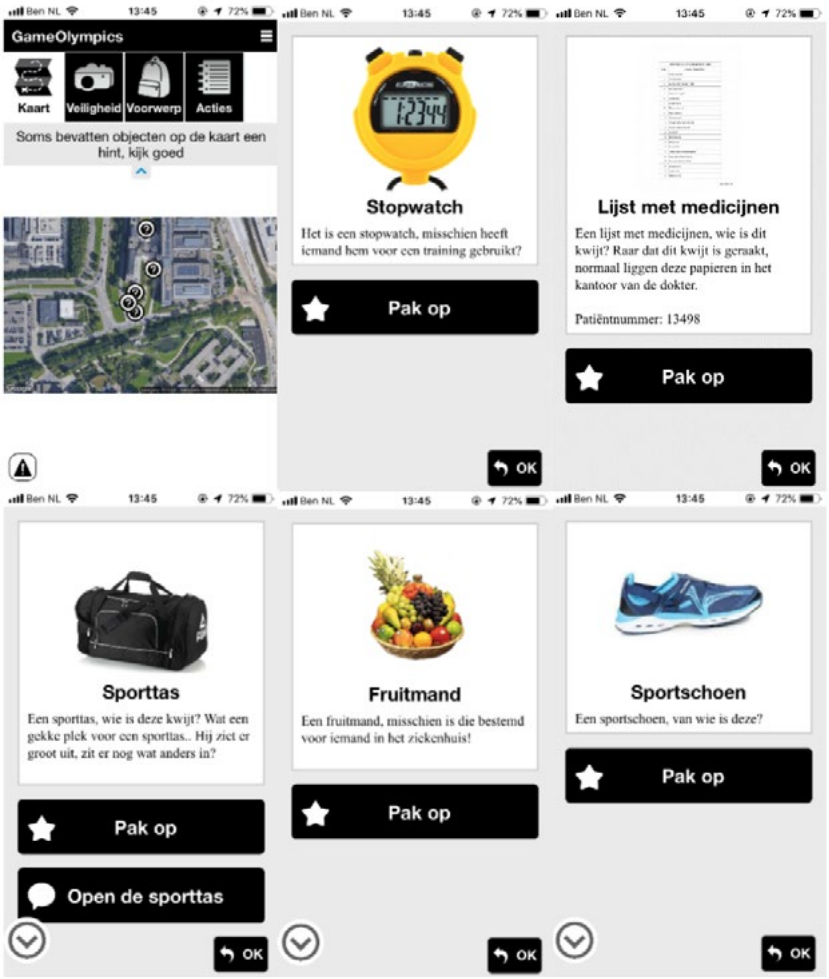


Figure 6. Locations in GameOlympics of in-game 'mysterious' items.

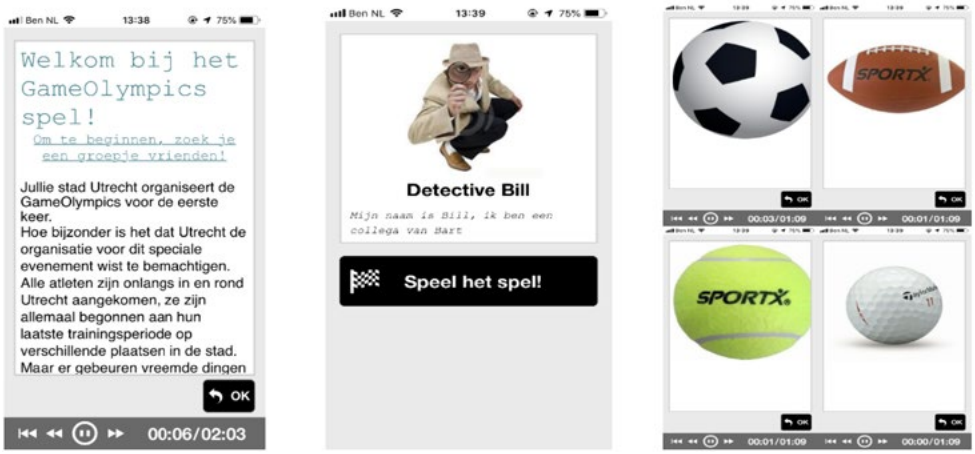


Figure 7. Elements in GameOlympics: narrative, detective, challenge.

Stage 4:	Play testing first prototype of the LBG on site
Input	Prototype game
Task	Student: getting feedback from volunteer testers
Tool	TaleBlazer, http://taleblazer.org/
Format	Iterative document design, in consultation with stakeholders
Duration	Half day preparation, plus half day play testing with multiple volunteers Two weeks iterative improving successive versions
Evaluation and expected results	Student: presentation of findings: process, good and bad experiences, suggestions for improvements Children: provide feedback to the presentation

For example, the Game Olympics game was tested with volunteers during the Week of the Game at Utrecht University, see https://www.uu.nl/en/events/games-and-lectures-during-week-of-the-game.

Stage 5:	Testing the LBG on site
Input	The developed Olympic Games in the City game, and a questionnaire to collect feedback of the game, see Appendix C. “Game Experience Questionnaire II”.
Task	Go on site and test the game with the target group and ask for their feedback.
Tool	TaleBlazer and questionnaire
Format	Introduction by school teacher in class, on site testing the game, filling out questionnaires in class
Duration	14 hours preparation with school teachers, parents/carers, paediatricians 2 hours testing with the children, collecting questionnaires
Evaluation and expected results	Student: report describing evaluation, results, and conclusions Children: active participation in testing, filled out questionnaire

Stage 6:	Final presentation
Input	All course experiences and results
Task	20-minute presentation and answering questions
Tool	Free choice
Format	Presentation and interaction with audience
Duration	One a day preparation and presenting
Evaluation and expected results	The game, presentation, results, and the whole process are evaluated on the basis of the formulated motivation, objectives, methodology, evaluation, results, and conclusions. See Appendix B.1 for the rubrics, evaluation is performed by the supervisor.

4. Evaluation of the course

There are two types of evaluation within the course:

- The evaluation of the game, the game development process and play test, done by the chronically ill children class. Appendix C. “Game Experience Questionnaire II” shows a possible questionnaire.
- The evaluation of the student developer, done by the supervisor. Appendix B.1 “Student evaluation rubrics for course developer” shows a possible student evaluation rubric.

5. Practical advice on the development of the course

During the course:

- Make sure that the target group is involved in the early stages of development process and afterwards. This ensures that something is developed which is actually wanted by the target group;
- Children love to work together and be challenged as a group, but don’t make these challenges to elaborated or similar as other challenges. This will lead to dropping out of focus of certain individuals. Make sure that the in-game challenges are surprising and fitting in the context.
- Make sure that players are always stimulated. One moment of decrease of focus during gameplay can affect the results of the whole gameplay afterwards. This is also supported by the fact that some participants had trouble staying focussed after one of the iPads crashed.

6. LBG design platforms and AR tools adapted for chronically ill children and their potential

The first step of this project was making a tool choice. The choice of the tool, with which the location-based game will be made, needs to be determined based on some criteria. These criteria consist of:

- The system requirements
- The platform it operates on
- User-friendliness
- The working functionality for the user who develops the game
- Opinions & experiences of current users of the tool
- Advantages
- Disadvantages
- Costs

After an evaluation of the tools EnigmApp, Aris, Siftr, and TaleBlazer, the latter was selected. TaleBlazer is an augmented reality (AR) software platform. It's developed by the MIT Scheller Teacher Education Program (STEP) lab. TaleBlazer allows users to play and make their own location-based mobile games. By putting game elements into the real world, AR games are used to engage people in experiences that combine real landscapes and other aspects of the physical environment with additional digital information supplied to them by smartphones.

System Requirements

At the website of TaleBlazer the system requirements are divided into two categories; Mobile requirements and Editor Requirements.
General: Mobile devices must be equipped with enabled GPS positioning technology. And there must be sufficient storage to cache the game images and videos. At least 50MB is recommended.

IOS: For iOS version 6.0 or higher is required.

Android: For Android version 4.0 or higher is required. Also, is it necessary to have the Google Maps API be bundled with Operating System

TaleBlazer is expected to work on all modern browsers, but it has been tested on Firefox 9 or later, Safari 5 or later and Google Chrome.

User friendliness

With regards to the user friendliness TaleBlazer is a great tool. The application is clear, explanations about the workings of the tool are given. Also, the design of the application is clear, structured and this makes it very easy to use, especially in combination with the explanations in the application.

The developing tool can be a bit overwhelming at the beginning. A lot of buttons and menus can be selected. During the developing and the process of trying things it will become clear. TaleBlazer also offers extensive, in-depth tutorials. This helps to get understanding about the tool and its possibilities.

Functionality for developers

TaleBlazer offers a wide range of functionalities in the developing area. Developers can make stories, add buttons, questions, scores, videos and audio clips into the game. Also, indoor games with the help of Bluetooth beacons can be made, this might be especially useful for chronically ill children who are still in the WKZ for example.

Opinions & experiences of current users

Not much comments or experience about TaleBlazer can be found on the web, but the game is used by universities and organizations like zoos to develop location-based games for a specific topic of interest.
Advantages
TaleBlazer has some major advantages. First of all, the tool is available on iOS and Android, which means that the game can be developed, tested and played by many people. Another advantage is that the user can download the game in the application on forehand. This means that the internet connection is not needed when playing the game outside. TaleBlazer also offers a wide range of functionalities and an elaborated tutorial which covers all the different possibilities and options.

Disadvantages

The TaleBlazer editor might be a bit overwhelming at the beginning, but this is solved by practicing and using the tutorials.

Costs

TaleBlazer is free, the organization behind the tool is funded by external organizations.

You can find more detailed information and experiences about the imparted course in the report Empowering Disadvantaged Groups (Agterberg & Veltkamp, 2019).

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Appendix

Appendix A.: Course description

Appendix B.: Assessments and feedback material

Appendix C.: Game Experience Questionnaires

Appendix A.: Course description

A.1. Course structure

Learner	
Teacher	
Discipline	
Workload	
Duration	
Course format	
Course content*	Participants will: - learn, research, and report about the relation/interaction between green and blue infrastructure (green open spaces and water elements) and users' behaviours, - formulate motivation, objectives, methodology, evaluation, results, and conclusions as independently as possible (depending on target group), - learn and apply digital tools for analysing and sharing information about open spaces in their own city, - learn digital tools for designing and developing games, - adapt a given game concept to their local needs and own game ideas, and - apply/transfer the acquired knowledge to develop/create a location-based game (LBG) to encourage physical activity and social interaction in urban open spaces.
Learners' background	
Age	
Equipment*	In class room: - Computers with internet connection - Projector - Mobile devices (smartphones, tablets) with WiFi[1] access - Post-it, coloured cardboards In the field: - Mobile devices (smartphones, tablets) with internet connection - Cameras - Camcorders (optional) - GPS devices (optional) - Audio recording devices (optional)

Teachers' skills*	- IT skills (and optionally gaming software knowledge), - creative writing skills, - art skills, - physical education skills, and - optionally, game design skills. This type of skills can be best brought into the team by inviting an external expert to cooperate with the class

1 mobile internet (i.e. SIM card) is not mandatory if all the information is downloaded via WiFi **before** going on site.

Appendix B.: Assessments and feedback material

B.1. Student evaluation rubrics for course developer

		assessment				
		U	S	G	VG	F
Results	quality of the results					
	quantity of the results					
	complexity of the problem					
	Explanation:					
Thesis	structure					
	discussion of related work and context					
	clarity of presentation and correctness of arguments					
	English usage					
	general appearance (layout, figures and tables, etcetera)					
	Explanation:					

		assessment				
		U	S	G	VG	F
Presentation	structure and contents					
	quality of the slides					
	presentation skills					
	suitability for the audience					
	Explanation:					
Defence	ability to cope with technical questions					
	ability to cope with questions about context					
	Explanation:					

		assessment				
		U	S	G	VG	F
Execution	independence in execution of the project					
	independence in writing the report					
	planning and meeting deadlines					
	communication					
	total duration of the project					
	Explanation:					

B.2. Evaluation of the course

Please complete the following evaluation for the educational seminar you attended. Your feedback will help us evaluate the effectiveness of this program and allow us to make improvements in education. Thank you!

4 = Strongly Agree 3 = Agree 2 = Disagree 1 = Strongly Disagree 0 = No opinion

Please circle your response

1. The seminar met my expectations.	4	3	2	1	0
2. The content was helpful.	4	3	2	1	0
3. The level of the seminar was appropriate.	4	3	2	1	0
4. The format was enjoyable.	4	3	2	1	0
5. The guest presenters and workshops were helpful.	4	3	2	1	0
6. The structure of the seminar was logic.	4	3	2	1	0
7. The length and regularity of the meetings were appropriate.	4	3	2	1	0
8. I recommend that the seminar be repeated for other students.	4	3	2	1	0

What were the most useful aspects of the seminar?

What changes should be made to enhance/improve this program?

What additional information would you like to hear about?

Additional comments:

B.3. Evaluation of the course

Evaluation questionnaire for Students (the questionnaire can either be filled in in paper form or easily be transferred into a Google Form to be filled in online).

1. Age ……..
2. Gender ☐Male ☐Female

3. Which of the skills and knowledge below did you acquire through your participation in the course? Please tick ✓as appropriate:

Skills and knowledge	A great deal (5)	A lot (4)	To some extent (3)	A little (2)	Not at all (1)
I developed cooperation skills					
I developed my imagination					
I developed my creativity					
I learned about location based games and how to develop them					
I learned about the rules of a game, and how to design and improve a game in physical space					
I learned about online platforms for the development of LBG					
I learned how to build a simple game scenario					
I learned how to identify important structural elements of an open urban space					

4. How do you perceive now – after your participation in the course – the role of green and blue infrastructure in the city? Please tick ✓as appropriate:

	A great deal (5)	A lot (4)	To some extent (3)	A little (2)	Not at all (1)
Role of urban green and blue infrastructure					
The urban green and blue infrastructure promote health and offer opportunities for physical exercise even when they do not include designated sports facilities.					
The urban green and blue infrastructure play an important role in the everyday life of citizens.					
My perception about the importance of urban green and blue infrastructure has changed after participating in this course.					
I can now identify opportunities for physical exercise and wellbeing in an open urban space that I never thought of before.					

5. How do you perceive now – after your participation in the course – the use of mobile devices? Please tick ✓ as appropriate:

	A great deal (5)	A lot (4)	To some extent (3)	A little (2)	Not at all (1)
The mobile devices – smartphones and tablets:					
Can help visualize physical space better.					
Offer education opportunities for all.					
Can exercise imagination and creativity through the process of developing educational games.					

6. Did you find the process of the game development:
Please tick ✓ as appropriate:

	A great deal (5)	A lot (4)	To some extent (3)	A little (2)	Not at all (1)
Interesting					
Enjoyable					
Educational					

7. What more would you have expected during the game development stage?
Please tick ✓ as appropriate:

	A great deal (5)	A lot (4)	To some extent (3)	A little (2)	Not at all (1)
More guidance for the scenario development part.					
More guidance for the game transfer on the selected platform.					
More field trips.					
Other: Please give us your opinion!					

8. Do you have any other comments you wish to make?
Please specify.

Appendix C.: Game Experience Questionnaires

C.1. Game Experience Questionnaire I

This document contains the English version of the Game Experience Questionnaire developed by the Technical University of Eindhoven[1] and modified by the Technical University of Darmstadt.

Part 1: Game Core

Please indicate on the following scale how you felt while playing the game:

not at all	slightly	moderately	fairly	extremely
0	1	2	3	4

		1	2	3	4
1	I was interested in the game's story				
2	I felt successful				
3	I felt bored				
4	I found it impressive				
5	I forgot everything around me				
6	I felt frustrated				
7	I found it tiresome				
8	I felt irritable				
9	I felt skillful				
10	I felt completely absorbed				
11	I felt content				
12	I felt challenged				
13	I had to put a lot of effort into it				
14	I felt good				

1 IJsselsteijn, W. A., de Kort, Y. A. W., & Poels, K. (2013). The Game Experience Questionnaire. Eindhoven: Technische Universiteit Eindhoven.

Part 2: Game Objectives

Please indicate how much you agree with the following statements:

not at all	slightly	moderately	fairly	extremely
0	1	2	3	4

		1	2	3	4
1	The game made me exercise in a slight way				
2	The game made me exercise in a moderate way				
3	The game made me exercise in an intense way				
4	I discovered new opportunities to exercise				
5	The game made me go to places I have never been or I have only passed by…				
6	Playing the game made me interact with others				
7	When playing, I challenged myself regarding physical activity				
8	After playing, I understood the multiple functions of green and blue spaces, especially in relation to health, fitness and well-being of citizens				

C.2. Game Experience Questionnaire II

Questions have been asked in Dutch, but English translations are stated below each question.

---

1. Wat vond je van de game, en waarom?
Wat did you think of the game, and why?

Slecht Bad	Matig Avarage	Neutraal Neutral	Leuk Fun	Heel Leuk Really enjoyable

---

2. Hoe heb je het spelen van de game ervaren, en waarom?
How did you experienced playing the game, and why?

Slecht Bad	Matig Avarage	Neutraal Neutral	Leuk Fun	Heel Leuk Really enjoyable

Omdat:
Because:

---

3. Hoe leuk is deze game om met vrienden/vriendinnetjes te spelen, en waarom?
How fun is it to play this game with friends, and why?

Niet leuk Not fun at all	Matig Avarage	Neutraal Neutral	Leuk Fun	Heel Leuk Really enjoyable

Omdat:
Because:

---

4. Hoe vond je het dat jullie moesten samenwerken in je groepje?
How did you like the fact that you should cooperate with your group?

Niet leuk Not fun at all	Matig Avarage	Neutraal Neutral	Leuk Fun	Heel Leuk Really enjoyable

Omdat:
Because:

5. Hoe verliep de samenwerking tijdens de opdrachtjes?
How did the collaboration go during the challenges?

Slecht Bad	Matig Avarage	Neutraal Neutral	Prima fine	Heel goed Really good

6. Wat vond je van de opdrachtjes in de game, zoals het raden van de woorden en de cijfer-letter puzzels?
What did you like about the challenges in the game, like guessing the words and the number-letter puzzle?

Slecht Bad	Matig Avarage	Neutraal Neutral	Leuk Fun	Heel Leuk Really enjoyable

7. Wat vond je de leukste opdracht?
What was the best challenge according to you?

8.Wat vond je de stomste opdracht?
What was the worst challenge according to you?

9. Heb je nog andere ideeën voor zulke opdrachtjes?
Do you have other ideas for such challenges?

10. Kun je kort opschrijven wat volgens jou het verhaal van de game was?
Can you shortly describe what, according to you, the narrative in the game was about?

11.Wat vond je van het verhaal in van de game?
What did you think about the story in the game?

Slecht Bad	Matig Avarage	Neutraal Neutral	Leuk Fun	Heel Leuk Really enjoyable

12.Welke dingen vond je goed aan de game en wat kan er beter?
What things did you like about the game and what could be improved of the game?

13. Als je een cijfer moet geven over de samenwerking met je groep wat zou dit dan zijn, en waarom?
If you have to give a grade about the cooperation with your group, what would it be, and why?

1	2	3	4	5
6	7	8	9	10

14. Als je een cijfer moet geven over het verhaal van de game wat zou dit dan zijn, en waarom?
If you have to give a grade about the story of the game, what would it be, and why?

1	2	3	4	5
6	7	8	9	10

15. Kruis het cijfer aan. Geef een cijfer over hoe graag je dit spel nog eens zou willen spelen.
(1= nooit meer, 5= heel graag)
Tick the number. Give a grade about how much you would like to play this game again.
(1 = never again, 5 = very much like)

1	2	3	4	5

16. Kruis het cijfer aan. Geef een cijfer over hoe erg je dit spel zou aanraden aan anderen.
(1= nooit, 5= absoluut)
Tick the number. Give a grade about how bad you would recommend this game to others.
(1 = never, 5 = absolute)

1	2	3	4	5

17. Voel je je meer verbonden met je groepsgenoten?
Do you feel more connected to your group members?

Veel minder	Beetje minder	Evenveel	Beetje meer	veel meer
much less connected	a bit less connected	equally connected	a bit more connected	much more connected

18. Denk je dat als je zulke spellen vaker speelt dat je dan nieuwe vriendjes kan maken?
Do you think that if you play such games more often, you can make new friends?

Absoluut niet	Denk het niet	Weet ik niet	Misschien wel	Absoluut wel
Absolutely not	I don't think so	I don't know	Maybe	Absolutely yes

19. Welke dingen zouden volgens jou het spel leuker kunnen maken? Denk aan opdrachten, routes, puzzels, alles mag!
Which things do you think could make the game more fun? Think of assignments, routes, puzzles, everything is allowed.

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